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<p>This paper reviews the controversy concerning national industrial policy. It describes historical views of the role of government in controlling industry; and, it describes current political views on industrial policies. The paper discusses the negative effects of the long debate on the ability of the defense industry to provide for defense needs, and the probable result of continued disagreement. It proposes that an effective and politically acceptable role of government take active roles in shaping higher education</p>		

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toward industrial and manufacturing engineering, clarify anti-trust roles, and, most importantly, demand modernization of production capabilities, in return for reduced bureaucratic constrictions.

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**NATIONAL SECURITY AND THE
INDUSTRIAL POLICY DEBATE:
MODERNIZING DEFENSE
MANUFACTURING**

Lt Col Robert Latiff
COL Charles Beckwith
Col Thomas Smith

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The views expressed in this paper are those of the authors and do not necessarily reflect the official views of the United States Government, the Department of Defense, the US Army, the US Air Force, or Harvard University.

• 1991 Lt Col Robert Latiff
 COL Charles Beckwith
 COL Thomas Smith

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EXECUTIVE SUMMARY

Throughout history economists, politicians, and businessmen have debated about the proper role of government in directing and coordinating the actions of, or otherwise assisting, the nation's industries. The academic debates have taken the form of competing theories about comparative advantage among trading nations or the impact on economic efficiency of free-market versus interventionist policies. Politicians and industrial leaders have engaged in the debate generally when economic conditions have made it advantageous or necessary for them to do so.

After World War II, the United States was the undisputed world economic leader. Since the early nineteen seventies, however, US industries have been subject to vicious foreign competition and large losses in world market share. Consequently, the debate over industrial policy and calls for government help have returned and, indeed, intensified. The Bush Administration adamantly opposes, as did the Reagan Administration before it, any form of, or even discussion about, industrial policy. In response to constituent and other pressures, the largely democratic Congress continues to press for government action to assist industry and save American jobs. What is lost in the rhetoric is the fact that a multitude of government policies and programs already exist which directly

affect the fortunes of US industry. What may be needed is nothing more than to insure that these policies and programs are consistent and do not contradict one another.

While the US refuses to acknowledge the need for policies specifically designed to help its industries, other industrialized nations of the world openly support and aggressively pursue them. Japan and Germany, both democracies we helped to rebuild after World War II, harbor no reservations about government collaboration with industry. France, also a democracy, albeit decidedly socialistic, makes no apologies for championing its national industries. And while the Congress, the courts, and the American people would recoil at the idea of any US intelligence asset being employed for the good of industry, our adversaries and our allies freely employ theirs, especially in the search for US technology. It seems Americans in general confuse industrial might, profit, and direct government and industry collaboration, with flawed ethical and moral principles. What is needed is an understanding and acceptance that the arms-length, adversarial relationship between government and industry is both counterproductive, and unnecessary. There are means by which government and industry can work together that are ethical, moral, and will not result in undue profits for business at the expense of taxpayers.

At the same time the US was being challenged on the trade front, productivity growth was falling. The failure of the Congress and the President to come to terms with issues of industrial policy have resulted in an inability to reverse the trend of low

productivity growth. This in turn has led directly to a decrease in the standard of living for many Americans. The failure of Congress, the Executive, and the Department of Defense to come to terms on similar issues of defense industrial policy has resulted in an inability of defense manufacturers to respond at reasonable cost, in reasonable time, to national security needs. Continued inaction and prolonged debate on industrial policies will, most assuredly, mean continued decline of the US industrial power. Because of the complex nature of weapons and the way in which defense manufacturers have allowed their manufacturing facilities to age, prolonged debates over weapons acquisition policies and laws will result in further erosion of the defense industrial base, perhaps to the point that it will be unable to recover.

The most important economic issue in raising the standard of living of the people is productivity growth. An essential element of productivity growth, and the only renewable, non-exhaustible element, is technology as embodied in technological innovation. Manufacturing accounts for a large percentage of US exports and is absolutely essential in the production of weapons systems. It is widely accepted that the US is adept at product development, but has fallen well behind Japan and Germany in its process development capability, or ability to take products from the laboratory to production quickly. Logic tells us, therefore, that we can achieve the highest leverage, in both commercial and defense industries, by emphasizing innovation and modernization in manufacturing.

Although they have not been employed widely, the Defense

Department has policies and programs for manufacturing modernization in its contractor facilities. A renewed and expanded emphasis on these programs, with corresponding emphasis on the manufacturability of weapons designs, is clearly called for. In modernizing our weapons and the manufacturing capability, we must keep in mind flexibility, the watchword of the post-Cold War era. With the rapid change and unstable conditions which characterize the world situation, and the corresponding changes in defense requirements, our weapons making strategy should mirror our rapid response defense strategy. A concerted attempt at the transfer of benefits of defense manufacturing research to the private sector would be not only a prudent use of taxpayer money, but would also be one politically palatable way for the government to assist industry. Because defense is a large customer for US industry, it should play a large role in developing industrial policy or in rationalizing those policies already in place. To deny that fact could lead to continued increasing cost, inability to acquire needed weapons, and a diminished national security posture.

The Bush administration readily admits that US industry suffers a productivity problem. It does not so readily admit the fact that dependence on free-market forces has failed to solve the problem. Competition from other nations in trade, manufacturing excellence, and even education, has been astonishingly vigorous. It is time for the President to seize the initiative and mould public consensus on the most appropriate course of action to regain our industrial power. Public recognition that industrial power is a

critical consideration in US policy and that industry had the unwavering support of the government, would send a powerful message to the public and to our overseas trading partners. This simple recognition by the government must be followed by study and analysis of all policies affecting industry, from taxes to antitrust, from occupational health to contract law. Macroeconomic policies must be designed to encourage Americans to save, to discourage excessive debt, and to encourage industrial capital investment. It must be made clear to industry that the government is willing to help financially and with reasonable regulations and restrictions, but only in return for unequivocal commitments from industry to modernize. Finally, there must be a focal point within the government for industrial matters. That focal point must have access to the president, the respect of Congress and industry, and extensive knowledge of the American science and technology establishment and the Department of Defense. The President's Science Advisor, also the Director of the White House Office of Science and Technology Policy, is the most logical choice to perform such a mission.

PREFACE

In choosing to write about industrial policy, we were aware from the outset that a tremendous volume of material had already been written. It has been recognized for some time that the US was lagging in productivity, that the trade deficit was growing, and that the US defense industrial base, inextricably linked to the US industrial base and dependent on the economic health of the US, was in trouble. Numerous trade groups, academic institutions, foundations, and commissions have studied the problem and many have recommended solutions. Many studies have noted the inability of US industries to translate technical advances quickly into products and the inability or unwillingness of defense industries to produce weapons efficiently, noting with alarm the antiquated facilities of many defense firms and the long delay between weapons systems research and deployment.

What is different about this paper is that it is being written at a time when world events and national economic pressures have combined to create more of an opportunity for change than has been the case in the last four decades. The unfortunate existence of trade deficits, large budget deficits, and huge foreign investment in the US have created a clamor for some sort of action to restore US competitiveness. These cries of alarm have generally taken the

form of calls to protectionism; but in the more general sense they have been calls for an industrial policy, which the Reagan and Bush administrations have resisted. Fortunately, we are seeing now the collapse of communism throughout the world. Although the need for a strong national defense will not disappear, there is an opportunity, indeed a demand for decreased defense spending. It is this combination of intense financial pressure and rapidly changing security responsibilities that provides us a chance to introduce true reform and modernization into defense manufacturing and to use the modernized defense industrial base as a model for improved US industrial competitiveness. Such modernization and investment in manufacturing technology can lower the cost of weapons while increasing our weapons-making flexibility. The results of DOD research and development in manufacturing could reasonably be transferred to the civilian sector and, thereby, provide a politically acceptable form of government assistance to industry.

There are serious problems in the defense industrial base that require a more aggressive approach to industrial modernization. The US needs renewed national leadership in improving the state of manufacturing in America.

CHAPTER ONE
INDUSTRIAL POLICY, NATIONAL SECURITY, AND THE ECONOMY

Economists throughout history have debated the same enduring questions. Should a sovereign state take a mercantilist, interventionist approach toward trade or should it adopt a laissez-faire, free-market policy? What is the source of a nation's competitive advantage and how should it best be exploited? Closer to the subject matter of this paper, what is the relationship between economic security and national security and how do defense expenditures affect economic health? It would be naive of anyone, industrial policy advocate or not, to deny that the effect of government actions on the economy looms large. Markets, after all, have to operate within the framework of sovereign states. The real question is to what extent the government takes an active role in shaping the actions of industry. Should it merely provide the proper environment and tools with which industry can operate both nationally and internationally? In advanced nations, defense becomes a key element of government activity and the economy. Indeed, to some observers economic health and national security are almost synonymous.¹ Berger, et al, state that "because political and military power depend ultimately on economic vitality, weakness in the US production system will inevitably raise doubts about the nation's ability to retain its influence and standing in the world

at large."² It is worth noting that although we are discussing here historical arguments about the role of government in shaping industries in a market system, the defense industry does not fit into the category of a true market system with its single-buyer, monopsonistic relationship to the suppliers.

In this paper, we discuss the current state of the economy and the ongoing debate over whether the US does or should have an industrial policy. We focus on the drop, in recent years, in the rate of increase of US manufacturing productivity and some of its causes, especially the low state of manufacturing science and technology.

Industrial policy is those policies to which a government subscribes that guide its actions toward its industries and ultimately help determine the state of that country's economy. Policies in question can originate within any arm of government, and they derive their importance from their effects on industry. The key issues are how the individual policies affect each other, and what goals the government is trying to achieve with these policies. The US government has no explicit industrial policy. Indeed, the response to the question of why we do not is often a bitter denunciation of such policies, with the added statement that "we do not pick winners and losers."³ Such a response is shortsighted and reflects a misunderstanding of the need for rational and rationalized policies. First we must frame the question of what should constitute a US industrial policy. We must then clarify both sides of the debate that is occurring in the

press, in Congress, and in academia on the proper role of government in its relations with industry. We must ultimately demonstrate how lack of rational and rationalized policies have caused an erosion of the ability of the defense industry to respond to national security needs and how, in a dramatically changed post Cold-War world, we no longer have the means or the time to "muddle through."⁴

THE CURRENT DEBATE AND DEFENSE INTERESTS

In July 1990, Dr. Craig Fields, then Director of the Defense Advanced Research Projects Agency (DARPA), was abruptly relieved of his duties. While Defense Department officials insisted that Dr. Fields had been merely reassigned to a project of importance to the department, it is a widely held view⁵ that he had overstepped a boundary set by the President and his Chief of Staff concerning the administration's prohibition of any kind of industrial policy. The DARPA Director had entered into an agreement with an electronics company to fund a high-risk technology project, in exchange for which the company would return a percentage of future profits to the government. While agreements of this general type are common in research and development efforts, Fields's high-profile announcements of DARPA's activities, following as they did his publicly announced intention to support companies engaged in high-risk High Definition Television (HDTV) technology research, was too much for the administration to condone. Fields's dismissal was

perhaps the most vivid example of the administration's disdain for industrial policy, but it was not the first.

Months before, Secretary of Commerce Robert Mosbacher had been forced to change his publicly supportive stance of US efforts to push the HDTV industry.⁶ HDTV is of great interest to defense planners because of the much larger amounts of information and the greater accuracy of image it brings to computer screens and weapons displays. Whereas Mosbacher had only spoken in violation of the administration's policies, Dr. Fields had taken the extra step of providing DOD funding for contractor development of the high-risk technology. The DARPA Director and the Secretary of Commerce were attempting to provide government support to an industry they felt had the potential to become very large, with consequent economic advantages for the leader country.

Perhaps because they did not gather quite as large an audience, previous calls for industrial policy by DOD-commissioned organizations did not result in the wrath of the President. The Defense Science Board, in a 1988 report, went so far as to provide a draft Presidential Directive calling for industrial policies,⁷ and the Under Secretary of Defense for Acquisition said, "to the extent that these and other [industrial policy] issues affect the industrial base, the DOD intends to stimulate, when warranted, appropriate activities throughout government to address them."⁸

It is interesting to note here that the President's Science Advisor recently published a National Technology Policy that contains numerous references to joining with industry in efforts to

improve competitiveness.⁹ The difference between Fields's position (aiding a specific industry) and the position of the science advisor (supporting generic technology without targeting specific industries or companies) is that generic assistance is palatable to the tastes of the current body politic. Such assistance is described as funding, jointly with industry, pre-competitive, pre-application specific research. The scolding of Mosbacher and the highly public firing of Fields are only manifestations of a debate that has been raging, at some times more hotly than at others, since it became apparent in the late seventies that the US was losing its industrial and trade competitiveness in the world marketplace. This loss, and the inherent problems it highlights, are of concern to DOD because, as we shall later discuss, the national industrial base, in large measure, comprises the DOD industrial base.

What is so unusual about the current debate is the apparent role reversal of the players, something that has also been noted by Johnson.¹⁰ It has been the Republicans, long viewed as friends of industry and staunch supporters of capitalism, who have stood so adamantly against any form of help for ailing US industry, even in the face of withering attacks from foreign competition. On the other hand, it has been the Democrats, long champions of egalitarianism and the rights of the disadvantaged, foes of big business management, and supporters of labor, who have supported the calls for protection and aid to industry. Clearly, the debate

has a strong political dimension based, as Johnson points out, on saving jobs, strong lobbying, and other individual interests.

Concerning the often cited administration response that government should not pick winners and losers, both Moran¹¹ and the Congressional Office of Technology Assessment¹² point out that this answer indicates a fundamental misunderstanding of the problem. Moran says:

Despite the popular preoccupation with the ideological aspects of government intervention, the key issues for debate in fact lie somewhere apart from ideology, since the purpose of expending public resources is not to replace the market, but to perfect it, not to pick winners better than the market but to construct a showcase of candidates which otherwise would not be available for the market to appraise.

The current controversy over industrial policy seems to stem from differing views of what it comprises. Some see industrial policy as a complement to fiscal and monetary policies. According to Chalmers Johnson, "It involves the specific recognition that all government measures - taxes, licenses, prohibitions, regulations - have a specific impact on the well being of whole sectors, industries, and enterprises in a market economy."¹³

Pinder defines industrial policy in terms of instruments, such as taxes, rebates, and subsidies, which could be directed to aid specific industries or sectors.¹⁴ Others extract specific aspects of fiscal policy to aid industry as a whole, and they identify the relatively diffuse forms of support for American industry as competitiveness policy. These diffuse forms of support include "tax breaks for investment and savings, which indirectly help industry or taxes on consumption intended to raise the national

savings rate."¹⁵ Finally, there are those who feel that the nation's industrial might is so inextricably linked to our scientific prowess that our science and technology policy, to the extent that one can be identified, could be loosely called industrial policy.¹⁶

It is clear that there is no agreement on what industrial policy really is. We take the view, similar to Johnson's, that industrial policy is a recognition, on the part of national leadership, of the centrality of industrial performance to US well-being, and we urge the use of industrial health as a focus or a filter for government policies. Industrial policy is the rationalization of the set of all government laws, regulations, and actions that bear on the ability of US industry to produce efficiently and to compete, in terms of manufacturing productivity, in the world market.

HISTORICAL INDUSTRIAL POLICY DEBATES

Controversy surrounding the idea of industrial policy is not new. The classic modes of thought on the functioning of economies, in fact, disagree on whether the government should merely provide the means for markets to work or should actively intervene.

Economic liberalism has as its central feature a belief in the unfettered operation of natural market forces. Liberalism assumes that a market economy exhibits a powerful tendency toward equilibrium and that even with the imposition of some exogenous

factor, such as a change in productive technology, the market will restore itself to equilibrium. Most important, economic liberals believe that governments should not intervene in a market except where a market failure exists or to provide a public good.¹⁷

The core belief of the nationalist perspective, on the other hand, is that economic activities are and should be subordinate to the goal of state building and the interests of the state. All nationalists ascribe to the primacy of the state, of national security, and of military power in the organization and functioning of the international system.¹⁸

While Americans generally adopt the public stance of being for liberty, equality, freedom from government intrusion, and other so-called democratic and, in the economic sense, liberal principles, a tendency toward the nationalistic policies is, in fact, recurrent in the history of this country. Pinder has pointed out numerous instances of US government action that, while the US refuses to call them such, would be considered industrial policy in other nations. In 1792, for example, Alexander Hamilton recommended tariffs to help American industry. In the early 1800s, government grants were provided to encourage the spread of the railroads, and federal land rights for mining were distributed to encourage regional growth. After the Civil War, laws were enacted to permit the interstate operation of corporations. Since the 1930s, American farm policy, and changes thereto, have been the rule. The Tennessee Valley Authority is often cited as a key example of industrial policy. Finally, trade negotiations, import quotas, and

voluntary trade agreements on steel, automobiles, and on semiconductors are current examples of detailed government involvement in the success or failure of industries.¹⁹

As Gilpin points out, "throughout modern history, states have pursued policies promoting the development of industry, advanced technology, and those economic activities with the highest profitability and generation of employment within their own borders."²⁰ Finally, as Harvey Brooks so eloquently asserts, "Reliance on markets to generate innovation has never been as great or as universal as some current mythology, especially in the United States, would have us believe. Thus, government support for industrial innovation is nothing new, though it seems to have happened largely in response to political pressures rather than as part of a conscious general policy."²¹

While issues of economic policy and industrial policy have been debated throughout history, the implications of the current debate exceed the mere theoretical or academic. Unlike previous eras, the US is experiencing very real decline in its economic power and its standard of living.

LAGGING PRODUCTIVITY AND THE ECONOMY

It would be a mere academic exercise to debate whether or not the US should have an industrial policy, if there were not some problem on which that debate could hinge. Indeed there is such a problem. Quite simply, the American standard of living, which rose

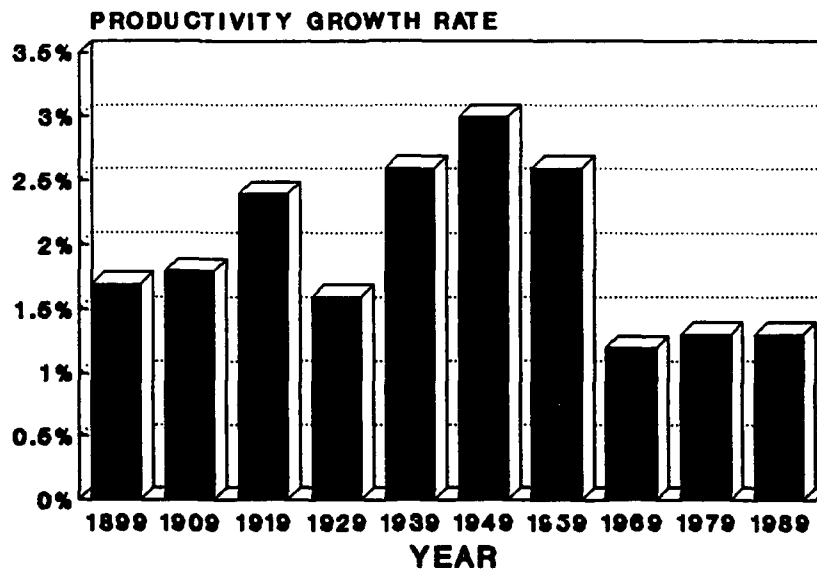


Figure 1-1: U.S. Productivity Growth 1899-1989

Source: Adapted from Paul Krugman, The Age of Diminished Expectations (Cambridge: MIT Press, 1990) 12.

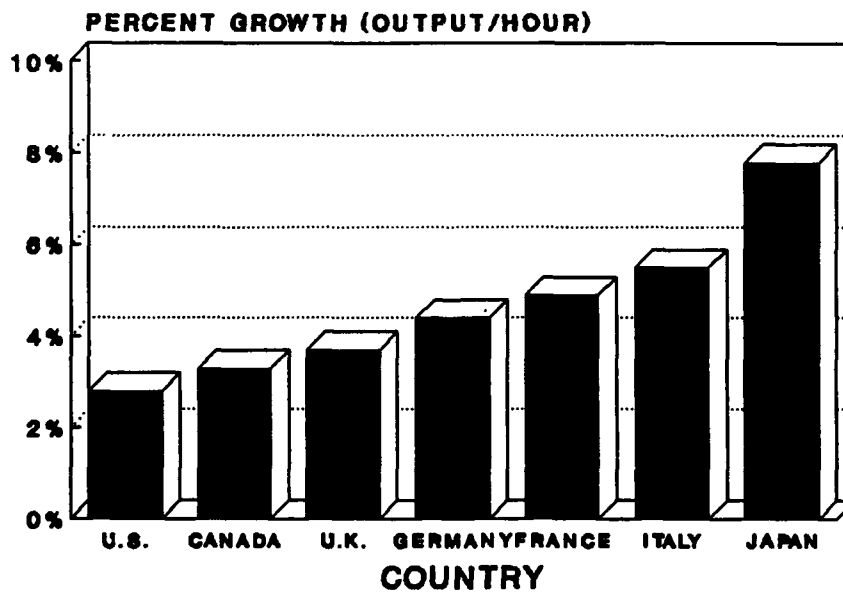


Figure 1-2: Average Annual Productivity Growth in Manufacturing

Source: Adapted from U.S. Department of Labor, Bureau of Labor Statistics, "International Comparisons of Manufacturing Productivity and Labor Trends, 1988," (Washington: GPO, June 1989).

so dramatically between 1945 and 1968, has failed to rise appreciably since then²² and this failure is due primarily to a failure to increase productivity. Figure 1-1 is a plot of productivity growth in the US from 1899 to 1989. Clearly, the US began to experience real problems in the seventies and eighties. Figure 1-2 compares US productivity growth in manufacturing to that of other industrialized countries.

Coinciding with the dramatic drop in productivity growth, average hourly earnings for selected industries also fell in the period 1973 to 1990, as shown in figure 1-3. The standard of living, measured by median income, has dropped because our source of income, trade, has declined. Figure 1-4 shows how our merchandise trade balance has worsened since 1976. We have consumed mightily, but our consumption has been of foreign goods and has been financed not by savings, but by borrowing. Figure 1-5 shows how the US has gone from being a creditor to one of the world's largest debtors. By not saving, we fail to provide a pool of funds from which US industries can draw to invest in productivity-enhancing modernization. Figure 1-6 compares the US savings rate to that of other nations. Dertouzos essentially confirms the importance of capital formation and national saving, but gives equal weight to all macroeconomic policies as well as non-macroeconomic and socio-organizational problems in US industries.²³ If we are not more productive than other nations, our goods become less profitable compared to other nations', and our national income will drop. The conclusion is obvious; our

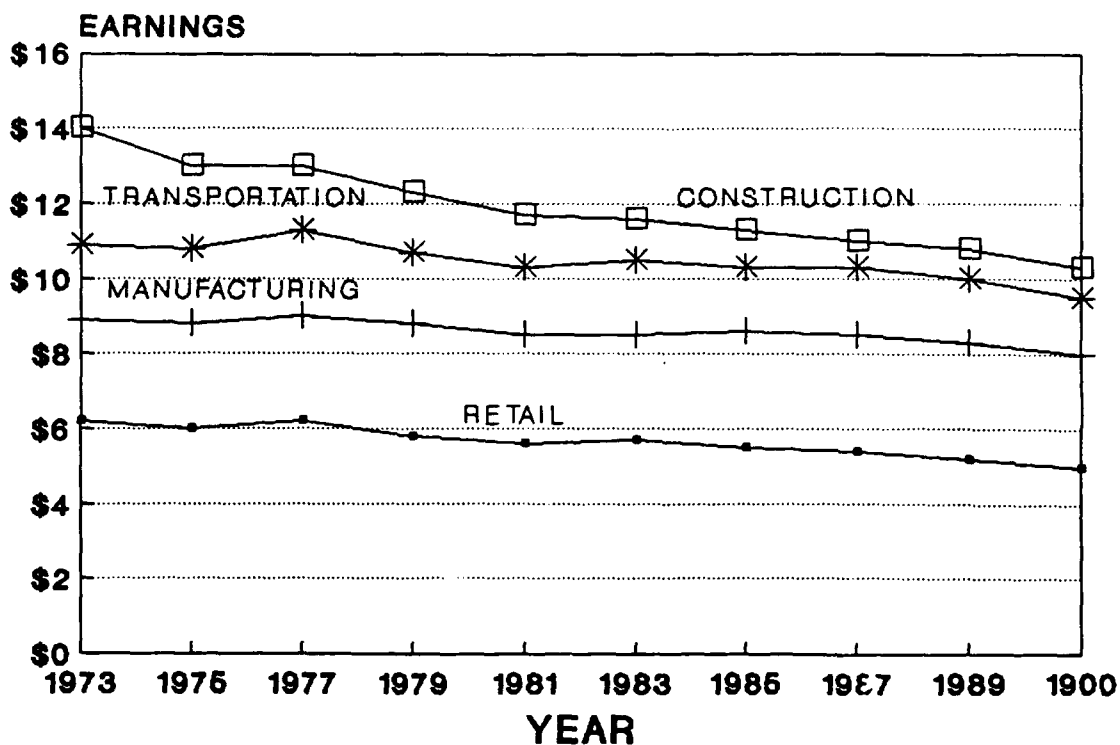


Figure 1-3: Average Hourly Earnings For Selected Industries
Source: Adapted from Louis Uchitelle, "Not Getting Ahead? Better Get Used To It," New York Times 16 December 1990: E1.

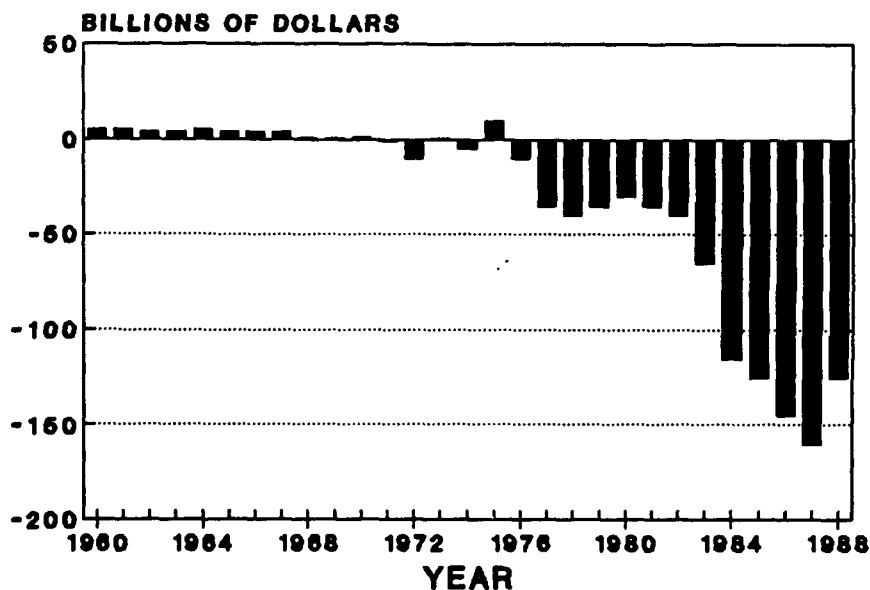


Figure 1-4: Merchandise Trade Balance 1960-1988
Source: Adapted from U.S. Department of Commerce, Bureau of Economic Analysis, Business Conditions Digest, September 1989 (Washington: GPO, 1989).

national competitiveness problem has lack of productivity at its core.

Increasing productivity is the only way we can improve our standard of living. Increasing employment or decreasing savings will work for a while, but eventually those resources will run out. If we include foreign trade, we can also borrow more to import more or we can raise the price of our exports. The former will work only while borrowing is possible, the latter only if our goods are more competitive, which means that we have to be more productive.

The only real, long-term, renewable resource is increased productivity, and we should note here the conclusions of the economist Joseph Schumpeter, who demonstrated that a major factor in productivity and productivity growth is technological innovation.²⁴ Krugman carries the conclusion a step farther saying that long-term growth in living standards depends almost entirely on productivity growth. He even correlates shifts in national power with productivity growth, noting that "since WWII, productivity growth in Britain has averaged about 1.5 percent a year: in Japan it has averaged 7 percent. Britain won the war and Japan lost; yet Britain has become a third-rank power while Japan is on the verge of becoming a first-rank one."²⁵ It should be noted, however, that Britain had national security responsibilities while, with the US as its protector, Japan could concentrate most of its national efforts on economic concerns. Kennedy sums it thus: "Major shifts in the world's military power balances have followed alterations in the productive balances."²⁶

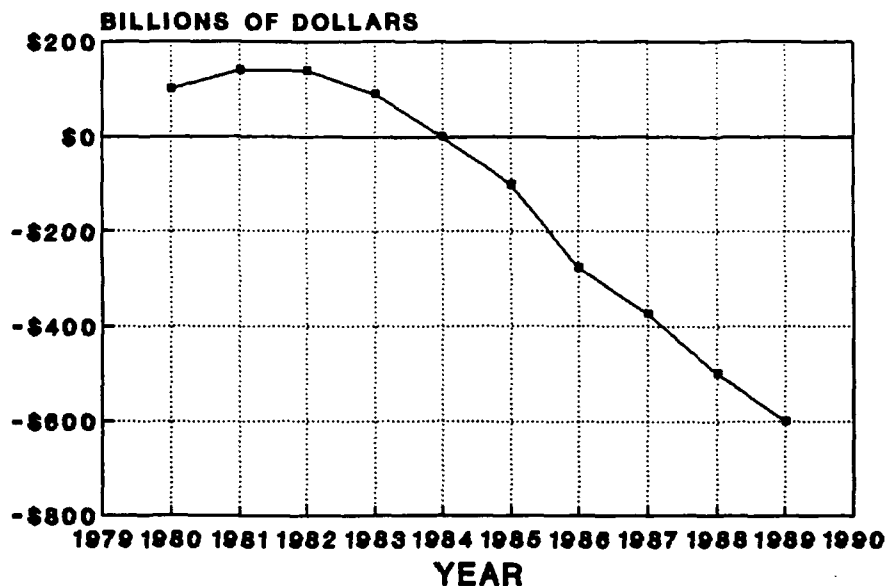


Figure 1-5: U.S. Net International Investment Position

Source: Adapted from Paul Krugman, The Age of Diminished Expectations, 39.

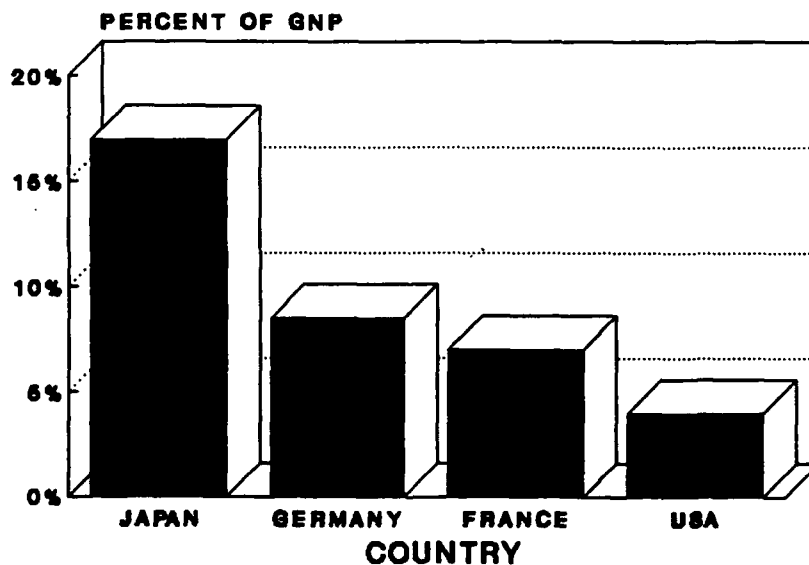


Figure 1-6: National Savings Rate Comparison

Source: Adapted from Paul Krugman, The Age of Diminished Expectations, 70.

WHAT OTHER COUNTRIES DO

A brief look at industrial policies and practices of other nations provides a vantage point for assessing our own position and for considering how we might proceed, either by imitation or by avoidance of known pitfalls. Consider that in 1950 the average productivity of Japanese workers was only 16 percent of US workers'; by 1973 it was 55 percent, and by 1979 it was 66 percent.²⁷ Or consider that after controlling for inflation, national spending on research and development (R&D) in Japan increased 640 percent between 1965 and 1987.²⁸ As these facts show, Japan brought itself from a relatively weak position after World War II to a position of industrial preeminence by the 1980's. As David Halberstam explains in his work on the US automobile industry, the Japanese emerged from World War II with a destroyed economy, lack of production materials, lack of natural resources, and a people in search of food and shelter.²⁹ One essential quality of the Japanese people that emerged was "a clear sense of common purpose."³⁰ Another was a realization that rebuilding and bringing the country to prosperity would take a long time and much disciplined effort. Nationally centrist attitudes that became important were the ability to take the long view and the acceptance of the need to sometimes deny immediate self-gratification. Decades later, consensus on long-range goals still allows the state to place burdens on its people that few American politicians would even consider. "Japan is prepared to absorb losses on export goods

indefinitely until entire [foreign] industries are brought to their knees. It makes up the deficits by "taxing" domestic consumers.³¹ Another major facet of Japanese historical tradition that emerged strengthened from World War II was respect for education and the commitment to competition for the benefits that education might offer. Taken together, self-discipline, a shared sense of long-term purpose, willing participation in programs for the common good, and deep respect for education and training form a solid base for industrial excellence in production and in the formulation of policy.

What the government of Japan employed in its rise to industrial productivity was a structure for confronting and overcoming the industrial challenges it faced after WWII. As Chalmers Johnson points out, "The Japanese institution which is primarily responsible for industrial policy is the Ministry of International Trade and Industry (MITI)."³² As evidence of the importance of MITI, Andrea Boltho asks us to consider that

before the capital liberalization of the late 1960's and 1970's, no technology entered the country without MITI's approval; no joint venture was ever agreed to without MITI's scrutiny and frequent alteration of the terms; no patent rights were ever bought without MITI's pressuring the seller to lower the royalties or to make other changes advantageous to Japanese industry as a whole; and no program for the importation of foreign technology was ever approved until MITI and its various advisory committees had agreed that the time was right and that the industry involved was scheduled for "nurturing."³³

In fact, the extent of Japanese government involvement, through MITI, in both "intervention and protection" was greater than any of its Western European counterparts after World War II.³⁴ Since

that war, MITI has applied its efforts in two directions: first, the identification and promotion of industries that promise long-term growth, and second, targeting of industries in decline. In applying its mandate, MITI

considers the whole range of potential government measures -- tax, anti-trust, special lending, price and capacity controls, export and import measures, environmental regulations, raw material price setting and procurement, technology subsidy, dislocation subsidy, regional policy -- which influence an industrial sector's performance and its effect on other sectors.³⁵

A second major agency of government that exerts powerful influence on behalf of the government is the Ministry of Finance (MOF), which essentially "sets limits on the scope of industrial policy and approves its financial particulars."³⁶ In the same sense that MITI adapted in structure and means to fit the needs of the nation, the financial side of Japanese industrial policy grew to suit the need. The Ministry of Finance applies its own arsenal of economic tools -- such as "selective tax measures, access to low-cost government lending, expenditure subsidies, tariff and customs policies, and foreign exchange rate changes"³⁷ -- in close coordination with and support of MITI and other pertinent agencies. In an editorial on "Tokyo's brand of industrial policy," Nicholas Wade asserts that "its key ingredient is abundant capital" for industry.³⁸ In 1990, Japan, "spent an astonishing \$590 billion on capital investment, exceeding the \$513 billion spent by the US"³⁹ The readily available capital flows in large part from the large pool of personal savings.

Many factors that have led to success for Japanese companies find emphasis primarily in relation to their differences from US corporations. Labor agreements in the Japanese automobile industry provide an excellent example of one of the basic differences. Typical Japanese agreements give many employees greater job security in exchange for employee flexibility and pledges of commitment to the company.⁴⁰ Those advantages with labor helped them avoid the poor US economic performance that Lester Thurow ascribes, in part, to the lack of "worker participation" in either policy making or operations.⁴¹

In yet another illuminating difference, a 1990 US Commerce Department study points out that while Japanese executives placed market share, and return on investment as their first and second objectives, American executives were primarily concerned with return on investment and raising the price of shares, with market share in third place.⁴² To gain market share, Japanese companies simply developed long-term capabilities and long-term customers by using profits to build new, up-to-date manufacturing facilities, by making a quality product that customers will return to, and by focusing on dealers and customers. In the US, tax and investment policies have encouraged short-term results, such as the payment of dividends to shareholders, rather than long-term capital investment and appreciation.

France, facing an economic crisis similar to that of Japan after WWII, gained consensus for national control of economic planning. But that task was made easier because the consensus

merely reinforced the long tradition of French government intervention in the growth of new industries and the acceleration of technological progress.⁴³ Like Japan, France developed institutions within the governmental structure to participate in and to direct national industrial policies. The *Fonds de Developpement Economique et Social*, which provides funding, the *Comite Interministeriel pour l'Amenagement des Structures Industrielles*, which provides loans for independent companies, and the *Agence Nationale de Valorisation de la Recherche*, which helps companies in innovation and new product development, are examples of the governmental structure that assists French companies.⁴⁴ Specific policies employed to benefit French information-technology companies "largely backed national champions"⁴⁵ as a means of concentrating certain specialties in one or two specific, large companies.⁴⁶ And, again like Japan, the concept was that the large "national champions" would protect the multitude of smaller producers that supplied and bought from them. It should be noted that the French policy is not widely regarded as successful. Significant progress in new technology has surely flowed from French government emphasis on cooperation with European Community (EC) members on well-known projects such as *Concorde*, the *Ariane Rocket*, and the *Airbus*. Recognizing clearly its direct competition from Japan, France supports state-owned companies by funding, by imposing

quotas on Japanese-made cars and televisions, [and] by pushing the European Community to slap dumping penalties on Japanese products. France has also pledged \$500 million to help Thomson [Groupe] develop high-definition

television -- in contrast to Washington, which declined to put up the money.⁴⁷

A final, controversial, industrial policy to which France and, reportedly, other countries subscribe is the use of national intelligence services to benefit industry. In a recent example, members of the French intelligence service were caught attempting to collect technical information from French subsidiaries of IBM and of Texas Instruments.⁴⁸

The similarities between Japan and France offer points worth noting on the possible application of industrial policy in the United States. First, both countries have enjoyed a relative consensus on the need for some form of central control. Second, these governments have established and employed a complex structure of agencies, ministries, and departments to plan and coordinate their policies. Third, each country has devoted specific and large sums of government money to develop commercial enterprises that could compete worldwide. Finally, each country has attempted to leave a certain portion of the operations of those commercial enterprises under private control. We believe that the important common elements in these countries' policies are the strong national consensus on the need for government to have specific policies toward helping industry and the fact that they created well-established structures specifically to support national industrial policy.

CONSEQUENCES OF PROLONGED DEBATE

As previously noted, neither the debates about government's role in helping the country's industries nor the recognition of sagging productivity and competitiveness are new. What are new, however, are the dramatic decline in the actual place the US holds in the world marketplace and the shift from worldwide military confrontation to worldwide economic competition. Although the US has been aware of the loss of entire industries to foreign competition, we have been unwilling to act decisively to stop it, preferring instead to depend on the market and attempting trade negotiations to halt what we felt were unfair practices. Nowhere has there been discussion of concerted attempt to help US industry compete.

The steel industry is a case in point. While Germany and Japan rebuilt after World War II, the US steel industry, enjoying virtual monopoly, failed to modernize. When it became apparent that low-cost imported steel was encroaching on our markets, and labor was becoming ever more expensive, the industry's demand and the government's response was to seek trade barriers. Only recently has some US-made steel, made by highly modern specialty mills, become competitive again.⁴⁹ The semiconductor industry is another example. When the Japanese became successful in adapting our inventions and technology to large-scale efficient production, we responded by taking the too-simple approach of negotiating quotas, which created additional problems of high cost for US

computer makers.⁵⁰ Only recently, in the form of a Defense Department and industry cosponsored research consortium called SEMATECH, has the US government made an attempt to attack the problem of efficient manufacturing, what we consider the root cause of the competitiveness problem. Continued, protracted debate and inaction on industrial policies will result in further erosion of production capabilities, especially defense capabilities, further loss of market share, or the surrender of other entire industries to foreign competition. While this is dire news for the economy, it would be an unacceptable result for national security planners.

NOTES

1. Donald J. Atwood, address, Keynote Session, Manufacturing Technology Advisory Group Conference, Washington, 30 Nov. 1989.
2. Suzanne Berger, Michael L. Dertouzos, Richard K. Lester, Robert M. Solow, and Lester C. Thurow, "Toward a New Industrial America," Scientific American June 1989: 39
3. Peter Petre, "Lifting American Competitiveness," Fortune, April 23, 1990. 60.
4. Ethan Kapstein, "Losing Control: National Security and the Global Economy," The National Interest Winter 1990: 85-90.
5. John Markoff, "New US Aid Sought for High Technology" New York Times 26 Apr. 1990: D-16; and Bruce Stokes, "High-Tech Tussle," National Journal Supplement Tuesday 12 Jun. 1990: B31-35.
6. Richard Brandt, Jonathan B. Levine, Robert D. Hof, John Carey, and Otis Post, "The Future of Silicon Valley," Business Week 5 Feb. 1990: 55-60.
7. US Department of Defense, Under Secretary of Defense for Acquisition, The Defense Industrial and Technology Base, Final Report of the Defense Science Board 1988 Summer Study (Washington: 1988) A1.
8. US Department of Defense, Under Secretary of Defense for Acquisition, Bolstering Defense Industrial Competitiveness (Washington: 1988) vi.

9. US Executive Office of the President, Office of Science and Technology Policy, US Technology Policy (Washington: 1990) 3.
10. Chalmers Johnson, "Industrial Policies," The Industrial Policy Debate, ed. Chalmers Johnson (San Francisco: ICS Press, 1984) 45.
11. Theodore H. Moran, "The Globalization of America's Defense Industries," International Security 15.1 (1990): 74.
12. US Congress, Office of Technology Assessment, Making Things Better (Washington: GPO, 1990) 20.
13. Johnson, Industrial Policy Debate, 45.
14. John Pinder, Takashi Hashomi, and William Diebold, Industrial Policy and the International Economy (New York: Trilateral Commission, 1979) 3.
15. "The Visible Hand," New Republic 26 Nov. 1990: 7.
16. Lewis Branscomb, "The Case for a Dual Use National Technology Policy," The Aspen Institute Quarterly 2.3 (1990): 48.
17. Robert Gilpin, The Political Economy of International Relations (Princeton: Princeton UP, 1987) 29.
18. Gilpin, Political Economy, 31.
19. Pinder, Industrial Policies, 23.
20. Gilpin, Political Economy, 189.
21. Harvey Brooks, "Efficient Public Technology Policy: Criteria and Evidence," Emerging Technologies: Consequences for Economic Growth, Structural Change, and Employment, ed. Herbert Giersh (Tubingen: JCB Mohr, 1981) 330.
22. Paul Krugman, The Age of Diminished Expectations (Cambridge: MIT Press, 1990) 11.
23. Michael L. Dertouzos, Richard K. Lester, and Robert M. Solow, Made in America (New York: Harper Collins, 1990) 37.
24. Joseph A. Schumpeter, Capitalism, Socialism, and Democracy (New York: Harper second edition, 1950) 82.
25. Paul Krugman, Diminished Expectations, 17.
26. Paul Kennedy, The Rise and Fall of Great Powers (New York: Vintage, 1987) 439.

27. Miroslav Nincic, United States Foreign Policy, Choices and Tradeoffs (Washington: Congressional Quarterly Press, 1988) 346.
28. Leonard H. Lynn, "Technology Policy in Japan," Forum for Applied Research and Public Policy Fall 1990: 58.
29. David Halberstam, The Reckoning (New York: Avon Books, 1986).
30. Thomas Hout and Ira Magaziner, Japanese Industrial Policy, (Berkeley: University of California, 1980) 37.
31. Brandt, 56.
32. Nincic, 348.
33. halmers Johnson, MITI and the Japanese Miracle (Stanford: Stanford University Press, 1985) 17.
34. Andrea Boltho, Japan: An Economic Survey (London: Oxford University Press, 1975) 187.
35. Hout and Magaziner, Japanese Industrial Policy, 40.
36. Hout and Magaziner, 38.
37. Hout and Magaziner, 38.
38. Nicholas Wade, "America's Last Robot?," New York Times 29 September 1990: 19.
39. Wade, 19.
40. James Womack, Daniel T. Jones, and Daniel Roos, "How Lean Production Can Change the World," New York Times Magazine, Part 2, 23 September 1990: 34.
41. Lester Thurow, The Zero Sum Society (New York: Basic Books, 1980) 8.
42. Clyde H. Farnsworth, "Report Warns of Decline of US Electronics Industry," New York Times 9 June 1990: 32.
43. Christian Stoffaes, "Industrial Policy in the High Technology Industries," French Industrial Policy, eds. Adams and Stoffaes (Washington: Brookings, 1986) 38.
44. Henry Aujac, "An Introduction to French Industrial Policy," French Industrial Policy, eds. Adams and Stoffaes (Washington: Brookings, 1986) 23.
45. Mark Dodgson and Ian Miles, "Technology Policy in Europe," Forum for Applied Research and Public Policy Fall 1990: 63.

46. Aujac, 29.

47. Steven Greenhouse, "France's Industrial Shogun," New York Times 16 September 1990, section 3: 6.

48. Herbert E. Meyer, "Banker, Broker, Businessman, Spy," CE/International Studies October/November 1990: 47.

49. Michael Schroeder and Walecia Konrad, "Nucor: Rolling Right Into Steel's Big Time," Business Week 19 Nov. 1990: 76.

50. Clyde V. Prestowitz Jr, Trading Places: How We Allowed Japan To Take The Lead (New York: Basic Books, 1988) 47.

CHAPTER TWO

DIVERGENT DEFENSE NEEDS AND INDUSTRY CAPABILITY

The longstanding inability of the US to develop and implement coherent policies affecting relations between industry and government has contributed to an increasing inability of American industry to compete and defense industry to respond, in a timely way, to national security needs. After World War II, while American academics, politicians, and industrialists argued over the proper role of government and the proper policies to establish concerning US industries, and while the Defense Department and Congress fought over weapons purchases and procurement law, the US slowly lost its ability to obtain the weapons it needed to actually fight a war. Dr. Jacques Gansler has summed up the situation:

Improving industrial responsiveness also requires money, which compounds the squeeze on available acquisition funds; thus for the last three decades, successive US administrations have been reluctant to take significant steps in this area. The result is a national security goal that is not matched by a corresponding military or industrial capability.¹

A key contributing factor to this inability to respond to defense needs has been the phenomenal increase in the complexity and technical content of weapons over time. Over this long period of cold war, the strategy of the US shifted from one of parity with the Soviets to one of superiority through technology. We entered into an arms race in which the value of a weapon was not in its

warfighting capability, but in the deterrent value of the adversary not having the technology or not knowing whether the claims we made about the technology were true.²

True enough, the US purchased a fair number of the weapons it developed, but fewer than planned.³ As newer items were added to the catalog from which the planners could choose, the last design became obsolete and had to be changed, generally at substantial cost. As costs rose, Congress became increasingly discontented and sometimes refused to fund a program for the number of items requested or canceled it outright. The situation became one in which technology advanced so rapidly, and DOD and Congress changed their collective minds so often, that defense companies were reluctant to invest much in the ability to quickly and efficiently build the item in question, preferring instead to make the best use they could of existing, if outdated, production facilities.

In essence, then, what we have seen during the cold war period is a continuing advance of weapon or product technology and a demand for that technology based on our military strategy. From an industry perspective, there has been an unwillingness, justified by the instability of defense demand, to invest in the necessary production or process technology and facilities. The result, as one might expect, is what Robert H. Fuhrman, Chairman of the Defense Science Board 1988 Summer Study, termed a "significant difference between industry's capabilities and the tasks which national security plans assume it can perform."⁴

THE SCOPE OF THE DIVERGENCE

We have noted the growing gap between the needs of the defense department and the ability of industry to respond to those needs. What is of interest is how serious the inability to respond has actually become. One of the most telling statistics resulted from a 1980 study by Air Force Systems Command.⁵ In an attempt to determine the ability of industry to stimulate a surge in production during a time of crisis, this study found not only that such a surge was not possible, but that the lead time for obtaining some critical items had gradually lengthened to over a year. Subsequent studies determined that while many of the prime contractors had excess capacity, that capacity was in many cases for assembly operations. What drove the long lead times was supplies of component parts from second- and third-tier contractors and suppliers. Table 2-1 shows some of the results of the Air Force study.

While lead times for crisis productivity surges and mobilization are important indicators, other manifestations of the increasing divergence between defense needs and industry capability to satisfy those needs are the generally increasing length of the weapons development cycle and the significant cost growth during the development cycle of most major systems. The time it takes for a weapon system to go from concept to production has risen steadily from a few years in the nineteen forties to a current average of fourteen years. This partially explains the fact that before a

WAITING TIME FOR COMPONENTS (Months)

ENGINES

Fuel Controls - 24
Gear Boxes - 22
Bearings - 23
Fan Blades - 19
Pumps - 16
Forgings - 13
Castings - 9

WEAPONS

Actuators - 25
Radomes - 21
Servos - 18
Harness - 18
Warhead - 14
Castings - 7
Bearings - 7

AIRCRAFT

Aux Pwr Unit - 27
Radar - 27
Landing Gear - 28
Wings - 27
Castings - 10
Forgings - 15
Eject. Seats - 18

Table 2-1: Waiting Time for Components

Source: Adapted from Air Force Association and UNLI Database, Lifeline in Danger: An Assessment of the United States Defense Industrial Base (Arlington: Aerospace Education Foundation, 1988) 3.

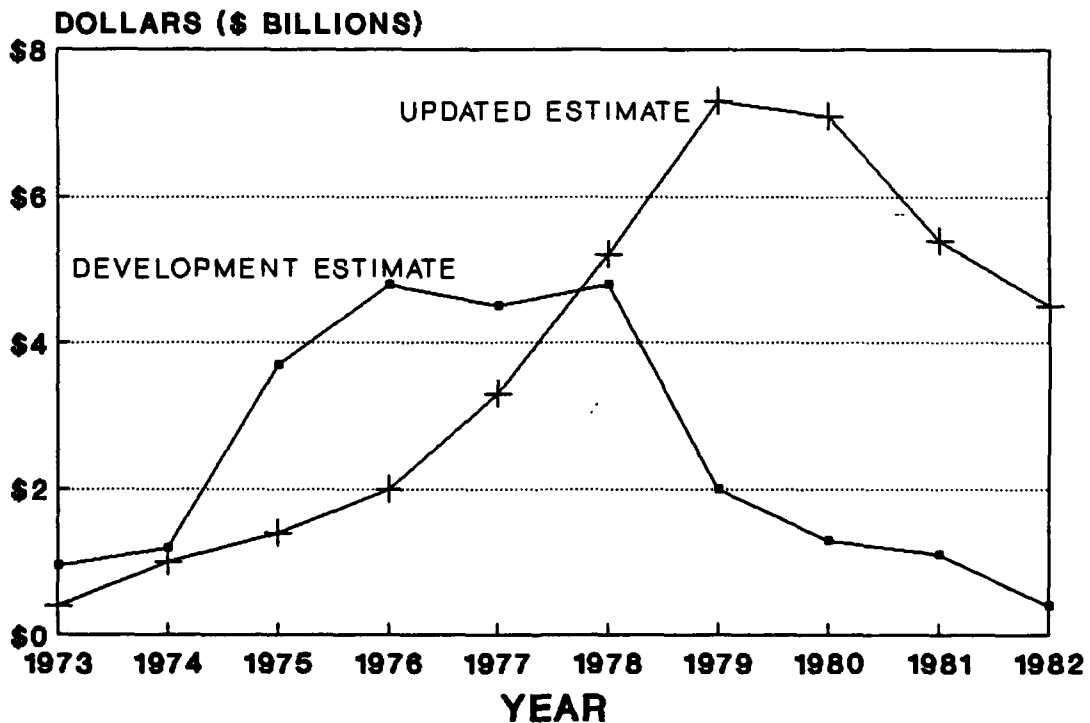


Figure 2-1: Weapon System Cost Increases

Source: Adapted from Jacques Gansler, Affording Defense, 129.

weapon system can be produced, the military requirements are likely to change. The cost growth on major programs is another indicator of the inability of industry to respond to defense needs. Companies either underestimate costs to win a contract or underestimate the complexity of the projects they are bidding on. Either way, the time allotted for development increases, further causing defense planners to look to alternatives. Figure 2-1 is a plot showing the average increase in weapon system costs for seven major programs.

REASONS FOR THE DIVERGENCE

The Threat and Increasing Complexity

There are two features of the threat facing the US during the long Cold War period that more than anything else shaped the actions of industry and government in weapons development. These features were the monolithic nature of our adversary and the rapid advance in weapons technology. After the entry of nuclear weapons and the US victory in the war, with its devastation of Japan and Germany, the US and USSR were the only two adversaries with nuclear weapons (China came considerably later, in 1949), and one could argue that neither really believed there could be a victor in a nuclear exchange. The cold war then became one of a search for technological superiority. A plot of unit cost versus aircraft program, figure 2-2, graphically depicts the enormous increase in cost and complexity of military aircraft since World War II. To

Indeed, it is a key element of US national policy to base its strategy on technological sophistication and qualitative superiority rather than quantitative superiority.⁷ During the Cold War, this strategy was a result of a combination of the increasing availability and performance of new technologies and an increasing inability to match the Soviets in numbers of weapons. In March 1983, President Reagan created the Strategic Defense Initiative, probably the most technologically complex and ambitious Defense program since the Manhattan Project⁸ and one that possibly convinced the Soviets they could neither technically nor financially continue the arms race with the United States. In terms of conventional conflict, the Under Secretary of Defense for Policy subsequently published a plan called "Discriminate Deterrence," which based the future conventional strategy of the US on high-technology stand-off weapons.⁹

Heavy dependence on advanced technology and sophistication is not without its dangers. In a monograph on industrial preparedness, the Manufacturing Studies Board of the National Research Council, warns that increased industrial specialization to produce sophisticated systems has made the US more vulnerable to voids in industrial capability. They expand on this concept by explaining that technological advantage is fleeting and that leading-edge technology is a target that can be surpassed by others, leaving the US with little or no industrial capability in other areas.¹⁰

Increased Regulation and Adversarial Relations

Along with the increasing sophistication of weapons and their increasing cost has come a shrinkage in the size of the industrial base and the number of companies involved. These trends inevitably brought on more oversight and regulation from Congress as more funding became concentrated in fewer companies. While this congressional oversight was intended to protect the taxpayer from paying too large a premium for weapons, most believe it was also an attempt by Congressmen to insure that some of DOD's largesse made its way into their state or district.

As a measure of how complicated the acquisition process has become, Burnett and Scherer point out that the Federal Acquisition Regulations comprise a three-volume set, with 1850 pages, prescribing profit policy, accounting standards, mandates for dealing with small business, and much else.¹¹ Congress also micromanages the process, in 1985 making 3163 program adjustments to Defense appropriations and requesting 458 special studies or reports from the Defense Department. It has been pointed out that in the period from 1982 to 1987, the number of firms involved in DOD work dropped from 118,000 to 35,000,¹² with the reason given that firms found the payoff was not great enough to justify the bureaucracy imposed or the risk that Congress or the administration might have a change of opinion and cancel the system. Gansler has estimated the annual cost of such micromanagement and excessive regulation at approximately \$16 billion.¹³

The relationship between government and industry in the US is not good by any measure. The adversarial relationship that exists reflects generally the mistrust of the people for large business conglomerates and central government authority. This poor relationship between government and industry is manifested in antitrust laws, restrictive profit policies for defense companies, and the refusal of the government to establish policies for the use of public funds to aid ailing industries. (The Chrysler and Lockheed bailouts were special cases and not government adherence to announced policies.) In the defense industry, it is reflected in the twenty-six thousand auditors DOD maintains to review every aspect of its supplier companies' defense operations. The relationship between DOD and industry reached probably its lowest point ever in the mid-nineteen-eighties with the revelations of overcharging for defense items, and continued to the present with the criminal charges brought against many industry executives. Such an atmosphere cannot result in the highly efficient communication required to achieve highly efficient weapons procurement. Baranson states the case clearly:

Adversarial confrontation between government and industry, industry and labor, industry and consumers, and among industrial firms themselves, drains vital human and financial resources that might otherwise be used to increase US industrial competitiveness¹⁴

Outdated Facilities and Equipment

Although there are some exceptions, defense manufacturing facilities depend on outdated equipment and process technologies.

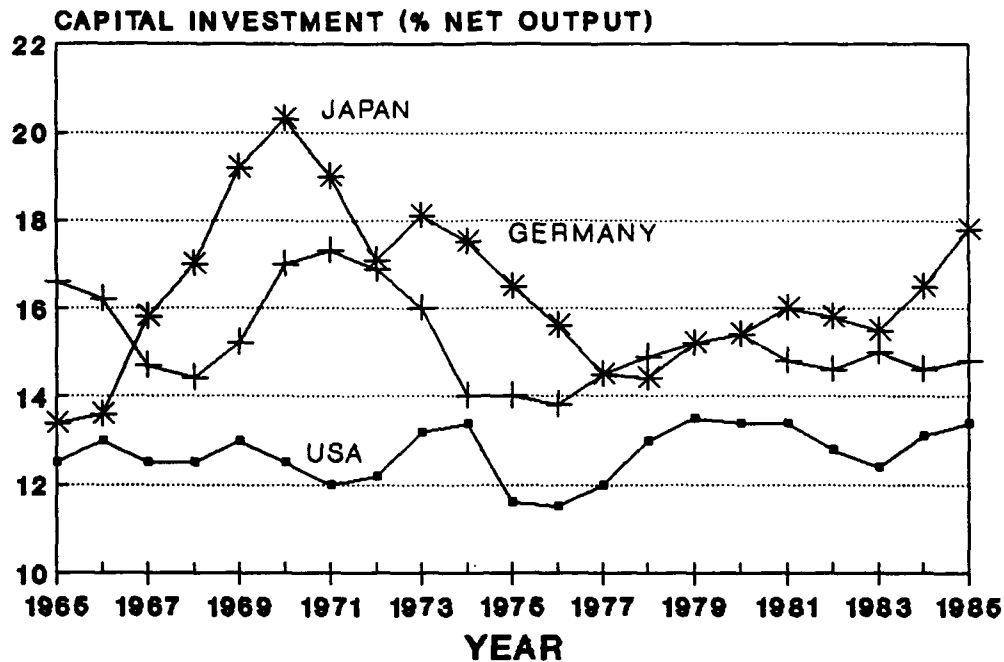


Figure 2-3: Business Sector Capital Investment

Source: Adapted from Organization for Economic Cooperation and Development, Flows and Stocks of Fixed Capital, 1960-1985 (Paris: OECD, 1987)

Figure 2-3 shows a comparison of percentage of capital investment in new equipment in industries in the advanced nations. Clearly, the US is lagging far behind in modernization. Even more sobering is the fact that in the US, the percentage of output of corporations devoted to manufacturing modernization, which is low at ten percent for commercial industry, is at a frighteningly low four percent for defense firms.¹⁵ Paul Seabury points out that sixty percent of the equipment now used for the production of military hardware is more than twenty years old, a proportion far in excess of the average for all US industry in the same age

bracket.¹⁶ Sammet and Green describe equipment in the defense industry as "aged," saying that many plants, associated tooling, and plant equipment are of World War II vintage.¹⁷

As mentioned earlier, there are a number of reasons for firms not to invest in productive equipment and new manufacturing technologies. Among these is the industry concern over the risks that the process might fail and put the program behind contract schedule or the risk that once company money is invested, the program could be canceled. The impact of using these antiquated facilities is increased cost of weapons, lower quality leading to higher cost, and the inability to efficiently and rapidly increase production or make changes to existing designs.

PAST ATTEMPTS AT CORRECTIVE ACTION

It has already been noted that government oversight of the defense industry has grown dramatically in the last decade. The large number of rules, regulations, audits, and reports have not, however, been totally unjustified. While the number of investigations and charges of misconduct in defense acquisition may be excessive, there have been a number of cases of shoddy workmanship, overpricing (although most of these reports have been overplayed), and actual fraud on the part of defense contractors. As a result there is a public outcry and a clamor for action. Rather than tackle the hard problems of defense acquisition system

reform, Congress and DOD respond by implementing still further controls.

There is a mistaken notion that defense industry profits are excessive. Actually they are no higher than in other industries, averaging about four percent of sales,¹⁸ yet DOD profit policy strictly limits the amount a contractor can make.

Fixed price contracts were an attempt to stop the escalating costs of systems by placing responsibility for overruns on the contractor. Responding to Congress's anger at cost overruns on development contracts, DOD required its contractors to assume all of the risk in highly risky programs. Rather than attack the problem by forcing more realistic initial estimates of costs, we forced the contractors to absorb all excess costs, driving some out of business.¹⁹

In another incorrect response in an attempt to control costs, DOD has imposed inadequate cost accounting systems on our contractors, making them keep two different sets of accounting records. DOD requires its own system, which collects the ever-decreasing direct labor content of work and ignores the details of the ever-increasing, and increasingly important, indirect or overhead labor content. The contractor must, in addition, keep another set of records to satisfy the Internal Revenue Service for tax computations.

VERY DIFFERENT POST COLD WAR ENVIRONMENT

The post Cold War era differs from the period since World War II in several major respects. First, the threat is fundamentally different. Second, serious budgetary problems will force large cuts in defense programs. While the situation will not be an easy one for Defense, there is an opportunity to begin the sorely needed reform of the weapon-buying and weapon-building process by using the so-called peace dividend to invest in the future by modernizing facilities. Defense can become the model for other sectors by making the hard long-term choices that will benefit future systems. Defense must first, however, choose what firms will survive in a declining budget era before it can decide to modernize. So far, DOD has been unwilling to make such a choice in the face of intense and inevitable reaction from Congress. A by-product of defense investment in factory modernization could be a spin-off of advanced manufacturing technologies into the civilian sector with a concomitant increase in productivity.

The Nature of the New Threat

With the fall of the Berlin Wall and the collapse of Communism around the world, it is tempting to think, even momentarily, that the US can finally relax some of its national security requirements. However, events such as the Iraqi invasion of Kuwait remind us that defense requirements, while they will differ, will continue to be a fact of life in the US. As pointed out by the

Carnegie Commission on Science, Technology, and Government,²⁰ our military requirements in the future, though considerably different from and less threatening than the cold war of the last four decades, will still be demanding.

The Commission also points out that although the threat of confrontation with the Warsaw Pact is almost gone, the potential for military conflict in the rest of the world is increasing. There is widespread concern over the proliferation of nuclear weapons and other weapons of mass destruction among Third World countries. What all of this means to the US was summed up by President Bush when he was asked to identify the threat toward which US military security should now be directed. He said, "unpredictability, uncertainty, and instability."²¹ What this implies for defense planners, and for those contracted to design, develop, and build weapons for the Defense Department, is summed up in the word "flexibility." In addition to being flexible, US forces and their suppliers will be forced to be quick and responsive. This will be discussed more fully in chapter 3.

The Defense Department must be able to make the case, convincingly, that some of the budget that Congress wants to slash can be put to use in reforming the processes and procedures by which weapons are decided upon and contracted for and, more importantly, improving the way weapons are manufactured and tested. In short, Congress and the American people must be convinced that an insurance policy,²² in the form of an improved technology base and advanced manufacturing technologies, is worth giving back some

of the peace dividend, and is, in the long term, a better use of the funds. William Perry, a former Under Secretary of Defense for Research and Engineering, in a speech given at Harvard's Kennedy School of Government, spoke about the changes in the post Cold War era.²³ He called for a revitalization of the reserves, but included in the term not only forces, but technology and the defense industrial base.

In order to start the process of convergence of industry capabilities and defense needs, we will have to know precisely what those needs and capabilities are. Dornbusch points out that an inventory of capabilities, surprisingly, is a serious deficiency in the defense business.²⁴ Also a serious deficiency is the inability to determine accurately the specific content of weapons systems with regard to parts and subassemblies and their sources. Another problem that has plagued planners in the past, but whose solution we desperately need to find, is that of determining what defense requirements really are. These requirements change rapidly, compounding the problems of industry. Once the capabilities of industry can be defined and the needs of defense can be set, the process of bringing the two into compliance can begin. The place to start this process of convergence is in manufacturing modernization.

NOTES

1. Jacques S. Gansler, Affording Defense (Cambridge: MIT Press, 1989) 10.

2. Harvey Brooks, "US Defense: Is Reform Possible?" International Security Winter 1989/90: 176.

3. William P. Rogerson, Inefficiently Low Production Rates in Defense Procurement: An Economic Analysis (Cambridge: Olin Foundation, 1990) 3.
4. U.S. Department of Defense, Defense Science Board, 1988 Summer Study (Washington, DC: 1988) cover letter.
5. U.S. Department of the Air Force, Air Force Systems Command Blueprint for Tomorrow (Washington, DC: 1980).
6. William B. Burnett and Frederic M. Scherer, "The Weapons Industry," The Structure of American Industry, ed. Walter Adams, (New York: Macmillan, 1990) 297.
7. U.S. Executive Office of the President, National Security Strategy of the US (Washington, DC: 1990) 22.
8. Robert Bowman, Star Wars: A Defense Insider's Case Against the Strategic Defense Initiative (New York: St Martin's Press, 1986) 43.
9. Commission on Integrated Long-Term Strategy, Discriminate Deterrence (Washington, DC: GPO, 1988) 8.
10. Manufacturing Studies Board, Industrial Preparedness: National Resource and Deterrent to War (Washington, DC: National Academy Press, 1990) 11.
11. Burnett and Scherer, 301.
12. James Blackwell, Deterrence in Decay: The Future of the US Defense Industrial Base (Washington, DC: Center for Strategic and International Studies, 1989).
13. Gansler, Affording Defense, 341.
14. Jack Baranson, "Government Policies in Support of Automated Manufacturing: Japan, the United States, and Western Europe," Competitiveness Through Technology, ed. Jerry Demer (Lexington: Lexington Books, 1986) 150.
15. Blackwell, Deterrence in Decay, 41.
16. Paul Seabury, "Industrial Policy and National Defense," The Industrial Policy Debate, ed. Chalmers Johnson (San Francisco: ICS, 1984) 204.
17. George Sammet Jr and David E. Green, Defense Acquisition Management (Boca Raton: Florida Atlantic University Press, 1990) 64.

18. Blackwell, Deterrence in Decay, 40.
19. Richard W. Stevenson, "Military Contractors Struggle As Rules of the Game Change," New York Times, Jan 6, 1991, 4.
20. Carnegie Commission on Science, Technology and Government, New Thinking and American Defense Technology (New York: Carnegie Commission, 1990) 10.
21. Carnegie Commission, 10.
22. Carnegie Commission, 10.
23. William Perry, Defense Investment: A Strategy for the 1990s, address, Kennedy School of Government, Harvard University, 4 October, 1990.
24. Dornbusch, Rudiger, James Porteba, and Lawrence Summers. The Case for Manufacturing in America's Future (Rochester, NY: Eastman Kodak Company, 1986) 11.

CHAPTER THREE

MODERNIZING AS A MEANS OF CONVERGENCE

By modernizing manufacturing facilities in the defense industry, DOD can begin to solve the core of the problem of its inability to obtain the weapons needed and, at the same time, take a large step toward the solution to the general problem of US competitiveness.

We recall the arguments previously made about the technical contributions to productivity and describe available DoD programs for manufacturing modernization. We highlight the fact that DOD has not adequately pursued efforts at modernization and assert that a renewed emphasis on modernization generally, and manufacturing technology development specifically, would give the US high leverage in attacking the high cost of weapons and lagging industrial competitiveness. We recognize the problems faced by US industry due to the high cost of capital, and argue that DOD has ways of helping its contractors overcome this hurdle. Finally, we argue that US manufacturing, led by DOD, must focus future thinking on flexibility and response, in the same way that our defense strategy will evolve in the coming years.

While our focus is on the importance of modernization, we agree with Gansler that it is a necessary, but by no means sufficient, condition for achieving improved productivity and

competitiveness.¹ Restructuring of the industry will be required.

IMPORTANCE OF MANUFACTURING

One of the key determinants of a nation's economy and, by implication, its standard of living, is the robustness of its international trade. It is also true that a substantial fraction of Gross Domestic Product (GDP), twenty percent, is accounted for by manufactured goods. The Committee on Computer Aided Manufacturing of the National Academy of Sciences has estimated that manufacturing is responsible for about two-thirds of the wealth created annually in the US and that technological advances provide the greatest contribution to manufacturing productivity increases and therefore to reducing the cost of generating wealth.² Dornbusch, Porteba, and Summers, discussing the effect of swings in the defense budget on the labor market, tell us that fifty-seven percent of all employment resulting from defense spending is in manufacturing.³ This strong defense influence on manufacturing represents a high degree of leverage and demonstrates the strong positive influence modernization could have on the general manufacturing economy and our weapons-making capability.

Clearly, the ability of US industry to manufacture goods efficiently and at lowest cost, for domestic consumption and for export, is of primary importance. On the defense side it is critical. If we are to solve the problem of the ability of defense

manufacturers to provide defense hardware, we must start by modernizing the means by which that hardware is produced.

THE STATUS OF MODERNIZATION

That modernizing manufacturing capability will lead to greater efficiency, lower costs, and improved sales for US manufacturers is hardly an arguable point. However, there are problems in implementation that make the situation more complex and sometimes argue against modernization. The high cost of capital, stockholder pressure, and the complexity of defense contracting policies are but a few of these problems. There are examples of highly successful companies in which these barriers have been overcome, with amazing results. In the private sector, John Deere Company is one such example. The company successfully implemented computerized machine tool and automated resource planning projects that dramatically reduced their work-in-process and indirect labor costs.⁴ As an example of a highly modern major defense factory, the General Dynamics F-16 plant at Fort Worth, Texas, is the often cited showcase, with its large number of automated systems and computer controlled machine tools. However, for every success, there are many problem companies. The steel industry has been noted. To it, add the US machine tool industry, which relinquished most of its market share to Germany and Japan by being slow to modernize. The heavy forging industry, so crucial to many defense

items, used old equipment that caused delivery times to grow to over a year in many cases.

Figure 2-3 depicted capital investment data comparing the US and its strongest competitors, Germany and Japan. While the US record in commercial investment is poor, even more startling is the low percentage of the defense procurement budget devoted to manufacturing investment. Of the hundreds of billions of dollars devoted to acquisition each year, DOD spends less than one percent on manufacturing modernization.⁵ The same is true of the percentage of the DOD budget for research and development. Of the \$38 billion spent each year, DOD spends less than one percent on process research. In contrast, world-class corporations spend between one-third and two-thirds of their total R&D budgets on such research.⁶

We conclude that US industry is increasingly unable to compete in efficient manufacturing and that manufacturing modernization is a reasonable place to start to attack the problem. We also recognize that it is, however, only a first step and that broader policy issues concerning technology emphasis and resource allocation will ultimately have to be addressed.

THE MEANS OF MANUFACTURING MODERNIZATION

Intelligent Choice of Product (Weapon) Technology

Before we can design efficient manufacturing methods and processes, we must learn to make intelligent choices of product

technology and design. It does no good to create an extremely effective weapon if that weapon is extremely complex to build, requires inordinate amounts of labor and expensive materials, and cannot be easily repaired. The Office of Technology Assessment points out that many contractors tend to emphasize labor-intensive product technologies that strive to reach the outside limits of performance. These contractors "concentrate on fancy, expensive new product technologies that will catch the eye of some project manager in DOD."⁷

The Advanced Medium Range Attack Missile (AMRAAM) is a case in point. The contractor, in selling the missile to the Air Force, described it as having the radar of an F-15 fighter in a space one-tenth the size. The company was attempting to adapt a design without first doing sufficient manufacturability studies. Subsequently, the contractor and the missile ran into serious manufacturing and quality difficulties. Senator John McCain, in discussing a long-term plan for research, development, and procurement, said that such a plan would have to recognize that there can be no lead in technology without an industry that can transform technology into development and production.⁸ In his recommendations to the President on national science policy, Dr. Alan Bromley, the Science Advisor to the President, said that "special emphasis needs to be placed on shortening the time period for transferring R&D results to production."⁹

Manufacturing Process Modernization

It is widely recognized that the US has a strong research and development establishment. Indeed, as in Japan and Germany, it devotes almost three percent of GDP to research and development. However, when the fraction of R&D funds devoted to defense is considered, the US is clearly ahead of all others, with almost one percent of GDP compared to Germany's tenth of a percent and Japan's negligible amount.¹⁰ There are some who think that the current competitiveness problem is a result of this large defense expenditure drawing away vast resources for the manufacture of non-commercial products and using many scientists and engineers who could otherwise be engaged in productive efforts to improve the US standard of living.¹¹ Gansler argues the point, saying, "No one has demonstrated that defense spending per se saps a nation's productivity."¹²

While we agree that some of the defense buildup, especially during the Reagan era, was excessive, the real problem is that too many resources were wasted in designing and producing weapons in old facilities using old manufacturing technologies. The Navy F-14 Tomcat is a case in point. An excellent battle-proven weapon system, the F-14 was labor-intensive and expensive to build because the contractor did not adequately invest in modern manufacturing technologies and equipment. Since the F-14 is a key element of the Navy arsenal, the government shouldered the cost of the resulting inefficiency.

The most insidious aspect of this wastefulness is that DOD and the services are aware of it and have the means at hand to eliminate much of it. Unfortunately, the services have shown only reluctant support for the Manufacturing Technology (MANTECH) Program and the Industrial Modernization Incentives Program (IMIP). These two programs, if implemented vigorously, have the potential not only to lower weapon system cost and increase quality, but, if properly diffused, to provide a basis for increased competitiveness industry-wide.¹³

The Manufacturing Technology (MANTECH) program has as its goal the development of advanced techniques and processes that are much too risky for the contractor to attempt to develop alone. In this program, the government provides funds for process technology development and the first set of whatever equipment is needed to implement the technology on the factory floor. In the IMIP program, the technologies are lower in risk, but the government provides incentives to the contractor to disrupt an on-going program in order to implement new equipment or techniques, especially when it will lower costs and thereby reduce the contractor's profit base.

Figure 3-1 shows the turbulent funding history for the Manufacturing Technology Program for the years 1983 to 1991. Savings from MANTECH investments have been estimated at three times the amount of the investments. Since the inception of the IMIP program in 1982 (formerly called Technology Modernization), the government has invested about five hundred million dollars. As of

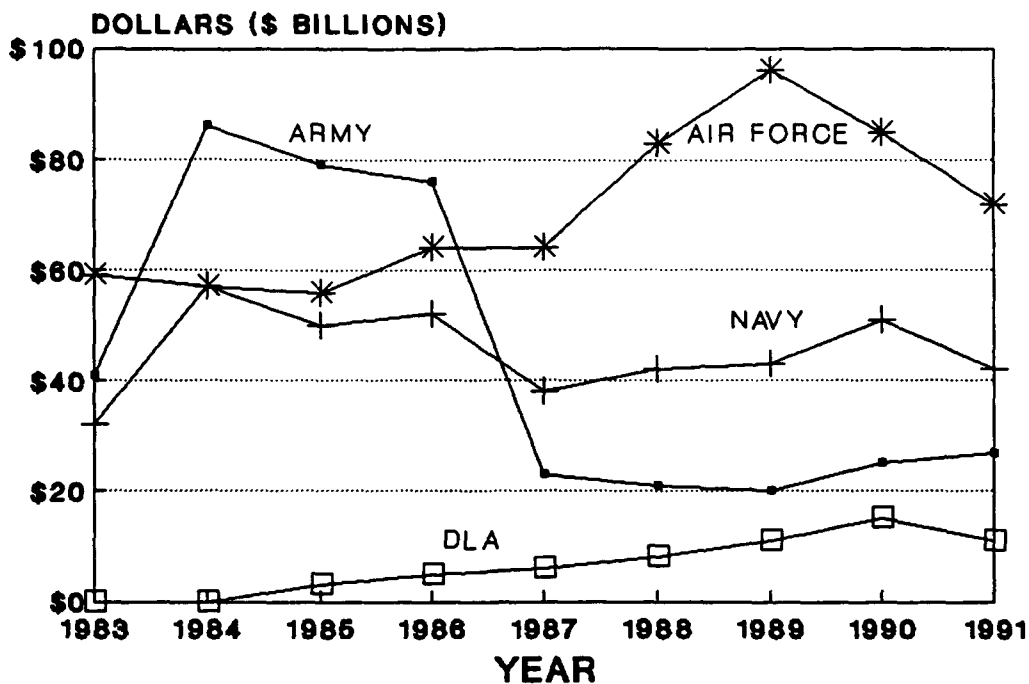


Figure 3-1: Manufacturing Technology Funding History

Source: Manufacturing Studies Board, Industrial Preparedness: National Resource and Deterrent to War (Washington: National Academy Press, 1990).

1988, six hundred and thirty million dollars in savings had been documented, with an estimate of almost two billion dollars saved by 1992.

With such demonstrated savings, why have these two programs not been widely used throughout defense? MANTECH projects are risky and could fail, causing a disruption in an ongoing program or a delay in starting a planned program, both things that a contractor wants to avoid. From the point of view of the service, the funds could simply be put to better use buying another piece of hardware or making product rather than process improvements. This

is the Defense Department equivalent of taking the short-term, bottom-line view, rather than a long-term investment oriented approach. Each year, OSD succeeds in getting money added to MANTECH and each year the services cut the program in favor of more hardware. The National Academy of Sciences has said that the potential leverage of the MANTECH program on defense manufacturing is enormous, but is hampered by lack of a coherent DOD policy.¹⁴

The Congress, long a supporter of manufacturing technology development, recognized the problem OSD was having in maintaining service support for MANTECH and acted to solve it. In addition to providing requested funds to bolster the defense technology base, they also provided funding and direction to DOD to place a higher priority on development of manufacturing technologies.¹⁵

Although the savings from MANTECH and IMIP are substantial, the contractor community has been slow to embrace these programs. Implementing MANTECH improvements and their associated productivity improvements does not necessarily confer a competitive advantage and may even harm a contractor's competitive position. The acquisition process, as alluded to previously, reimburses overhead costs as a percentage of direct costs. The contractor cannot then reduce costs without directly reducing his reimbursement. The IMIP procedure was intended to protect the contractor from such a reduction. However, these projects are not often embraced because of the excessive emphasis on and demand for audits of costs and savings and the requirement to share results of the modernization with competitors. Simply, the benefits of an IMIP to a contractor

are outweighed by the risk, especially since the government will continue to pay for building the items the old way.

If the solution to problems of old manufacturing equipment, labor intensive planning and control, and complex government regulation are important for the prime contractors, they are even more critical for the second- and third-tier subcontractors and suppliers. These companies account for 60 percent of the manufacturing value of a weapon system.¹⁶ Here is where a concerted effort on the part of DOD could vastly improve defense manufacturing and at the same time help commercial industry, since many of these lower tier companies also are commercial vendors.

Removing the Barriers

The problem of excessive audits of the IMIP programs has been noted by DOD¹⁷ and a change in policy is forthcoming in new versions of the DOD guidance. The new policy will reduce the emphasis on auditable savings and place renewed emphasis on investment in long-term improvements in productivity.

The cost of capital for US companies is simply too high. Figure 3-2 compares the cost of capital in industrialized countries. High capital costs translate into high product costs, which make US products less competitive in the world market. Defense companies are forced to answer to stockholders and must show profits rather than plow money back into capital improvements.¹⁸ Defense companies can succeed in postponing or eliminating productivity-enhancing and cost-reducing capital

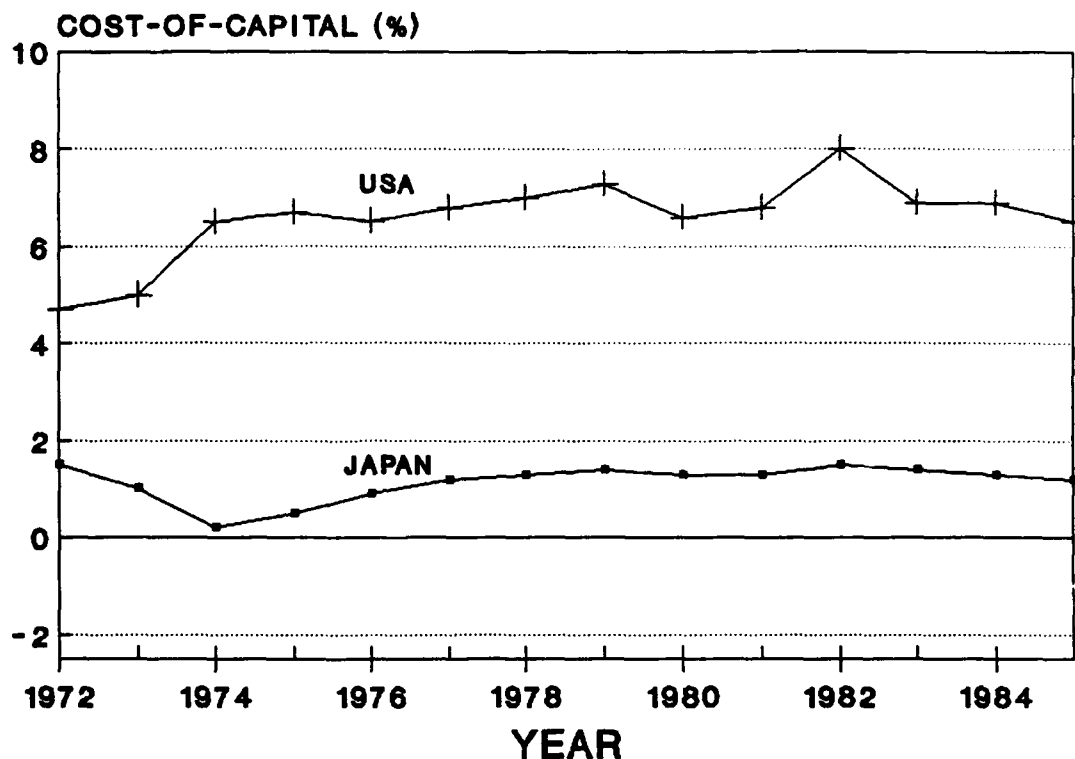


Figure 3-2: Cost of Capital Comparison

Source: Adapted from George N. Hatsopoulos, Paul R. Krugman, and Lawrence N. Summers, "U S Competitiveness: Beyond the Trade Deficit," *Science* 15 July 1988: 303.

improvements since they can, and often do, go back to the government for more money to cover the costs of inefficient production. Government policy seems to condone this solution rather than force changes that would lower the cost of investing.

MANUFACTURING SHOULD MIRROR DYNAMIC DEFENSE STRATEGY

It is clear that the security situation in the coming decade will call for a more flexible response in terms of weapons and forces than we had in the cold war. Also, if the US is to remain

competitive in world markets, we will have to take a more customer-oriented approach to products, responding more rapidly to consumer desires and demands for customization. Unfortunately the mechanical integration that in the past has been introduced to increase the output of (existing types of) capital equipment also sharply raises the cost of major product design change.¹⁹

If we are to be able to respond quickly, with different types of weapons or products, both the defense industry and industry in general will have to move more quickly away from the old means and methods of mass production toward a radically different manufacturing ethic. Whereas before we could afford, or at least the money was made available, to overstate capacity requirements and then let capacity sit idle,²⁰ we must now design our manufacturing processes and facilities to be efficient at varying levels of production. Ayers and Miller bluntly assert that "the only viable long-term strategy for US based manufacturing firms is to shift quickly to batch production mode and at the same time to accelerate their traditional rate of product innovation."²¹ In the past, we had the luxury of large defense budgets and the advantage in both military and civil technologies. These advantages are diminished, and we must work harder and more intelligently. A new mode of thinking about manufacturing strategies becomes an imperative.

Our economic and military readiness posture in the post Cold War era must be characterized by flexibility and responsiveness. While some MANTECH and IMIP programs are aimed at improving the

flexibility of the entire manufacturing enterprise, many of them are intended to reduce cost and increase the efficiency of older factories by implementing automation. It is in the application of computer integrated manufacturing in the so-called Flexible Manufacturing System (FMS) that industry and defense will reap the desired benefits. Research currently underway at Harvard's Kennedy School of Government on post-cold war force structures calls for a change from the practice of forward basing to what is termed "dynamic defense,"²² a system wherein forces are structured and based to respond to a variety of conflicts quickly. Because of all of the uncertainties about defense needs discussed in chapter 3, manufacturing capabilities need to mirror the strategy of dynamic defense. Flexible manufacturing systems appear to be the answer. These systems provide the ability to respond quickly to changes in the market or a changed technological environment by modifying the product accordingly. Since the systems are computer-based and computer-driven, they also allow for the development of very robust and highly detailed data packages. These data packages could contribute greatly to the ability to delay production of an item after its full-scale development if funding problems develop. Flexible manufacturing systems by themselves are not a panacea, but the concept, a truly advanced form of manufacturing modernization, should be considered for wide implementation in defense production.

Just as highly mobile and highly responsive forces suffer from being too large and too heavy or having too much overhead cost, the same is true, for different reasons, for the defense industry. The

aircraft industry is currently utilized to only about 55 percent of its capacity. With the number of aircraft being produced dropping and modernizing the existing plants, capacity utilization would drop to about 26 percent; clearly efficiency is not improving overall. What is required then is some shrinkage in the industry, as well as the responsive production brought by the FMS systems mentioned above, in order to achieve the true advantages of modernization.²³

NOTES

1. Jacques S. Gansler, letter to Robert H. Latiff, 16 May 1991.
2. Committee on Computer Aided Manufacturing, Manufacturing Studies Board, Report on Activities, January 1980 to June 1981 (Washington, DC: National Academy of Sciences, 1981) 5.
3. Dornbusch, 11.
4. George Kuttickal Chacko, Robotics/Artificial Intelligence/Productivity: US-Japan Concomitant Coalitions (Princeton: Petrocelli, 1986) 91.
5. Committee on the Role of the Manufacturing Technology Program in the Defense Industrial Base, Manufacturing Studies Board, The Role of the Department of Defense in Supporting Manufacturing Technology Development (Washington, DC: National Academy of Sciences, 1986) 20.
6. Gansler.
7. US Congress, Office of Technology Assessment, The Defense Technology Base (Washington, DC: GPO, 1988) 50.
8. Sen. John McCain, (R-AZ), "The Self Destruction of America's Defense Industrial Base," Armed Forces Journal International, June 1990, 40.
9. US Executive Office of the President, Office of Science and Technology Policy, US Technology Policy (Washington, DC: 1990) 5.
10. Peter Morici, Reassessing American Competitiveness (Washington, DC: National Planning Association, 1988) 129.

11. Baranson, Competitiveness Through Technology, 150.
12. Gansler, Affording Defense, 87.
13. US Department of Defense, Manufacturing Technology Program (Washington, DC: 1990) 13.
14. Manufacturing Studies Board, Manufacturing Technology: Cornerstone of a Renewed Defense Industrial Base (Washington, DC: National Academy Press, 1987) 2.
15. US House of Representatives, National Defense Authorization Act for Fiscal Year 1991, Conference Report (Washington, DC: GPO, 1990) 121.
16. Gansler, Affording Defense, 258.
17. US Department of Defense, Bolstering Industrial Competitiveness (Washington, DC: 1988) xii.
18. Phillip Finnegan, "Investor Groups' Increasing Clout Worries Industry," Defense News June 11, 1990: 1.
19. Robert U. Ayers, "Computer Integrated Manufacturing and the Next Industrial Revolution," Competitiveness Through Technology, ed. Jerry Dermer (Lexington, MA: Lexington Books, 1988) 14.
20. William P. Rogerson, "Inefficiently Low Production Rates in Defense Procurement: An Economic Analysis," report for the Olin Foundation, Feb. 1990, 3.
21. Robert U. Ayers and Steven M. Miller, Robotics and Flexible Manufacturing Technologies (Park Ridge: Noyes Publications, 1985) 20.
22. Thomas L. Allen, Kelly R. Gray, John F. Kehoe, James E. Lightfoot, and Joseph R. Oliva, Dynamic Response: Restructing the Military for the 21st Century (Draft) (Cambridge: National Security Program Discussion Paper, Harvard University, John F. Kennedy School of Government, 1991).
23. Gansler.

CHAPTER FOUR PRESCRIPTIONS FOR CHANGE

So far we have talked about the historical disagreement over the proper government role in dealing with industry and the dimensions of the current debate concerning what to do about the competitiveness problems of American industry. We have shown that the effect of our inability to rationalize our policies, combined with the ever-escalating complexity and instability of defense requirements, is an inability of industry to respond efficiently to defense needs. We now have a situation in which all the appropriate factors are arrayed to allow industry capabilities and defense needs to converge. We think that the stimulus for that convergence could easily be a program of modernization of defense manufacturing capability. While tools are available to effect such modernization, policies and regulations either discourage or at least do little to encourage it.

What is needed is strong leadership and vision on the part of government and industry leaders, understanding by the public of a need to change savings and consumption patterns, and a willingness on the part of government to change outmoded laws and policies and replace them with less adversarial ones. Industry must police itself to prevent abuses. Finally, there needs to be an organization, not necessarily a new one, at the highest level of

government, charged with the responsibility to develop and implement rational policies for industry.

LEADERSHIP, VISION, AND PUBLIC BEHAVIOR

The public debate over issues of industrial policy and the outcome of that debate are important to the nation and necessary to obtain the proper solutions to those issues.¹ At some point, however, the leader needs to emerge and help to shape a national consensus, not dictate a solution. As Heifetz and Sinder state in an essay on political leadership, "clinging to a specific public policy as one's own will often lead to failure because it is essentially an apolitical policy formulation."²

The public debate on industrial policy has been conducted since the late seventies, and the government has essentially instituted a series of independent measures to quell the calls for coherent policy. It is time to shape public consensus. We also pointed earlier to the deleterious effect on modernization and capital investment of US saving and consumption patterns. This problem, too, can be successfully addressed. Krugman and Hatsopoulos point to the changes in the national energy ethic as a result of the 1974 energy crisis, a change stimulated by public rhetoric and public policy.³ Similar changes occurred in public environmental awareness and attitudes toward smoking. It is possible that we could be successful with a public opinion campaign aimed at improving our national savings rate. Rosecrance in his

article on the state of American decline, states that "given a major shock or stimulus and a favorable environment, nations can alter a trajectory of decline."⁴

Once again, as in the postwar period with its dizzying advances in technology, the DOD can play a vanguard role and lead the country by example and action. Unfortunately, the overall direction of the defense industry, like US industry in general, is being allowed to drift. Action is being largely determined by events and initiatives from Capitol Hill, not the Pentagon. DOD must create a focus and a vision of how the future defense industry is to look and then take action and put in place the programs to make that vision a reality.⁵

RECOMMENDED POLICY INITIATIVES

Economic

We have discussed the need for greater savings to increase the pool of money available for capital improvement. We recommend incentives for long-term savings with corresponding disincentives for short-term transactions and speculative gains such as leveraged buyouts (LBO). We also support reductions in the capital gains tax rate for long-term capital gains and moderate increases in gasoline taxes, alcoholic beverages, tobacco, and luxury items, to reduce consumption.

Antitrust

Antitrust legislation, and more specifically the government position regarding enforcement of that legislation, must be clarified. The National Cooperative Research and Development Act of 1984 improved the ability of companies to join forces on highly risky research programs. However, the economic effects of the law are limited by the fact that research costs account for a small part of the costs of new products. Development accounts for a larger portion of the costs, and many companies are still wary of extensive involvement because of the vagueness of the law about how aggressive they can be. We recommend clear, unequivocal guidance from the Justice Department on their guidelines for enforcement of the current antitrust laws. Further, Congress should consider new legislation to replace the old antitrust laws, written before US companies were compelled by international competition to join forces.

Defense

Because weapons are so quickly outdated, the Defense Department must work with the Congress to obtain changes in tax laws that will allow much faster depreciation of defense contractors' capital equipment. Contractors justifiably are reluctant to invest in such equipment if it is obsolete well before it can be depreciated. Faster depreciation will go a long way toward solving contractors' cash flow problems, thereby effectively reducing their cost of capital.

Contractors are often reluctant to invest because, in addition to changes in DOD requirements, Congress often changes funding levels or cancels programs in their annual deliberations on the budget. Congress should provide funding for wider use of multi-year contracts. The DOD should demand in its contracts, in return multi-year purchases and the stability associated with such purchases, that the contractor agree to invest in modernization and new manufacturing technologies.

To directly lower the cost of capital for defense contractors is beyond the power of DOD. However, by judicious use of progress payments the DOD can ease the cash flow problems of its contractors. DOD can also encourage use of Internal Research and Development (IR&D) funds for manufacturing research. Perhaps most importantly, DOD can require in its contracts with the prime contractors that the provisions for MANTECH and IMIP projects be made part of the contract between the prime contractor and his suppliers. This would result in the modernization of that seventy percent of defense manufacturing below the prime contractor and would make inroads into sections of the manufacturing base that would benefit commercial manufacturers as well as DOD.

The Defense Department should establish as policy a commitment to plant modernization in its contractors and its own facilities. The commitment could take the form of a fixed percentage of the procurement budget for a weapon system being set aside for process technology development and equipment modernization. Even one percent of the total DOD procurement budget would amount to

approximately one billion dollars per year. Such a figure would represent an order-of-magnitude increase.

Finally, the DOD, in cooperation with Congress, must move toward a shrinkage of the defense industry as a whole. This will require a critical examination of requirements and the efficiency of the current companies in meeting those requirements. It may also require that funding be made available for retraining of workers displaced by the closing of some defense plants and for the redistribution of some technology, labor, and equipment. Short-run costs may be high, but long-run efficiency and responsiveness will be improved.

Education

The US government currently provides funding, through the National Science Foundation, the Defense Department, and other agencies, for operation of colleges and universities. Scholarships, grants, and loans from the government account for a substantial fraction of the financial aid offered on many campuses. In 1989, for example, the federal government provided an estimated 59 percent of the funding for research and development performed in academic institutions.⁶ Through its financial leverage, the government should change the emphasis in educational institutions from a very heavy focus on basic science and research to one that places more emphasis on technology and engineering, specifically industrial and manufacturing engineering. The Defense Department is taking some initial steps in this direction through the Defense

Advanced Research Projects Agency's support of university manufacturing science programs.

ORGANIZATION TO DEVELOP AND MANAGE US INDUSTRIAL POLICY

We noted that both France and Japan have central agencies that control their industrial activities, while the US does not. We do not recommend any additional government organizations. On the contrary, we feel the US has adequate structure already in place to manage the coordination of policies, which we feel is the most sorely needed activity.

The Office of the Science Advisor to the President is the most appropriate place for industrial policy coordination as we define it. This office has close ties to the high-technology community, an increasingly important aspect not only of product development, but of process development as well. The Science Advisor has sufficient access to the White House and Congress and sufficient independence from outside interests to be an impartial judge of the efficacy of policies. In addition, placing the responsibility for manufacturing excellence and industrial competitiveness in the office of the science advisor would increase the stature of industrial and manufacturing engineering in the nation's research and education institutions. Wholly adequate technical support is available to him, with a proper budget, to conduct the analyses of related policies and laws to determine if they are contradictory, or what their effects will be. Finally, the Science Advisor has

the capability to work within the Senior Interagency Group (SIG) process and the National Security Council to insure proper coordination of policies occurs at the appropriately high level of government.

NOTES

1. Robert B. Reich, "Policymaking in a Democracy," The Power of Public Ideas, ed. Robert B. Reich (Cambridge: Harvard University Press, 1990) 123.
2. Ronald A. Heifetz and Riley M. Sinder, "Political Leadership: Managing the Public's Problem Solving," The Power of Public Ideas, ed. Robert B. Reich (Cambridge: Harvard University Press, 1990) 196.
3. George N. Hatsopoulous, Paul N. Krugman, and Lawrence N. Summer, "US Competitiveness: Beyond the Trade Deficit." Science 15 July 1988.
4. Richard Rosecrance, "Must America Decline," Wilson Quarterly Autumn 1990: 83.
5. Gansler.
6. National Science Board, Science and Engineering Indicators - 1989 (Washington, DC: GPO, 1989) 108.

WORKS CONSULTED

Adam, John A. "Military Forces After the Cold War." IEEE Spectrum. Washington, DC: Institute of Electrical and Electronic Engineers, November 1990.

Adelman, Kenneth L. and Norman R. Augustine. The Defense Revolution: Strategy for a Brave New World. San Francisco: ICS Press, 1990.

Air Force Association and UNLI Database. Lifeline in Danger: An Assessment of the United States Defense Industrial Base. Arlington, VA: Aerospace Education Foundation, 1988.

Allen, Thomas L., Kelly R. Gray, John F. Kehoe, James E. Lightfoot, and Joseph R. Oliva. Dynamic Response: Restructuring the Military for the 21st Century (Draft). Cambridge: National Security Program Discussion Paper, Harvard University, John F. Kennedy School of Government, 1991.

Atwood, Donald J. "Speech to Manufacturing Technology Advisory Group/Industrial Modernization Incentives Program Meeting." Washington, DC: Department of Defense, 1989.

Aujac, Henry. "An Introduction to French Industrial Policy." French Industrial Policy. Eds. Adams and Stoffaes. Washington, DC: Brookings, 1986.

Ayres, Robert U. "The Robotics Society." Robotics and Flexible Manufacturing Technologies. Eds. Robert U. Ayres and Steven M. Miller. Park Ridge: Noyes Publications, 1985.

Ayres, Robert U. "Computer Integrated Manufacturing and the Next Industrial Revolution." Competitiveness Through Technology. Ed. Jerry Dermer. Lexington, MA: Lexington Books, 1988.

Baranson, Jack. "Government Policies in Support of Automated Manufacturing: Japan, the United States, and Western Europe." Competitiveness Through Technology. Ed. Jerry Dermer. Lexington, MA: Lexington Books, 1986.

Behrman, Jack N. Industrial Policies: International Restructuring and Transnationals. Lexington, MA: D.C. Heath, 1984.

Berger, Suzanne, Michael L. Dertouzos, Richard K. Lester, Robert M. Solow, and Lester C. Thurow. "Toward a New Industrial America." Scientific American June 1989.

Blackwell, James. Deterrence in Decay: The Future of the US Industrial Base. Washington, DC: Center for Strategic and International Studies, 1989.

Blinder, Alan, S. Testimony to Joint Economic Committee, Washington, DC: US House of Representatives, 1989.

Boltho, Andrea. Japan: An Economic Survey. London: Oxford University Press, 1975.

Bowman, Robert. Star Wars: A Defense Insider's Case Against the Strategic Defense Initiative. New York: St. Martin's Press, 1986.

Brandt, Richard. "The Future of Silicon Valley: Does the US Need a High Tech Industrial Policy to Battle Japan Inc?" Business Week. 5 Feb. 1990.

Branscomb, Lewis M. "The Case for a Dual Use National Technology Policy." The Aspen Institute Quarterly Summer 1990.

Brodie, Bernard and Fawn M. Brodie. From Crossbow to H-Bomb. Bloomington: Indiana University Press, 1973.

Brooks, Harvey. "U.S. Defense: Is Reform Possible?" International Security Winter 1988/1990.

Brooks, Harvey. "The Technological Factor in US Competitiveness." Business in Contemporary Society Autumn 1989.

Brooks, Harvey. "Toward an Efficient Public Technology Policy: Criteria and Evidence." Emerging Technologies: Consequences for Economic Growth, Structural Change, and Employment. Ed. Herbert Giersh. Tübingen: J.C.B. Mohr, 1981.

Bruchey, Stuart. The Wealth of the Nation. New York: Harper and Row, 1990.

Burnett, William B. and Frederic M Scherer. "The Weapons Industry." The Structure of American Industry. Ed. Walter Adams. New York: Macmillan, 1990.

Carnegie Commission on Science, Technology, and Government. New Thinking and American Defense Technology. New York: Carnegie Commission, 1990.

Chacko, George K. Robotics/Artificial Intelligence/Productivity: U.S.-Japan Concomitant Coalitions. Princeton: Petrocelli Books, 1986.

Chandler, Alfred D. Scale and Scope: The Dynamics of Industrial Capitalism. Cambridge: Belknap Press, 1990.

Commission on Integrated Long-Term Strategy. Discriminate Deterrence. Washington, DC: GPO, 1988.

Defense News. "Industry Faces New Directions for the 1990's." Sept. 1990.

Dertouzous, Michael L., Richard K. Lester and Robert M. Solow. Made In America. New York: Harper Perennial, 1989.

Diebold, William Jr. Industrial Policy as an International Issue. New York: McGraw Hill, 1980.

Dodgson, Mark and Ian Miles. "Technology Policy in Europe." Forum for Applied Research and Public Policy Fall 1990.

Dornbusch, Rudiger, James Porteba and Lawrence Summers. The Case for Manufacturing in America's Future. Rochester: Eastman Kodak Company, 1988.

Economic Commission for Europe. Recent Trends in Flexible Manufacturing. New York: United Nations, 1986.

Finnegan, Phillip. "Investor Groups' Increasing Clout Worries Industry." Defense News 11 June 1990.

Finnegan, Phillip. "Companies Sacrifice R&D to Survive Cuts." Defense News 2 July 1990.

Gansler, Jacques S. "Defense Acquisition Reform: Can We Get More With Less." Armed Forces Journal International Jan. 1990.

Gansler, Jacques. Affording Defense. Cambridge: MIT Press. 1989.

Gilpin, Robert. The Political Economy of International Relations. Princeton: Princeton University Press, 1987.

Gomory, Ralph E. "From the Ladders of Science to the Product Development Cycle." Harvard Business Review Nov.-Dec. 1989.

Gordon, George. "US Must Protect Defense Base." Defense News 24 September 1990.

Granier, Dan. Multinational Corporate Power in Inter-State Conflict: The Toshiba Case. Cambridge: John M. Olin Institute for Strategic Studies, Jan. 1990.

Greenhouse, Steven. "France's Industrial Shogun." New York Times 16 September 1990.

Halberstam, David. The Reckoning. New York: Avon Books. 1986.

Hamit, Francis. "Keep US Spies Off Corporate Payroll." Defense News 20 August 1990.

Hatsopoulos, George N., Paul R. Krugman, and Lawrence H. Summers. "U.S. Competitiveness: Beyond the Trade Deficit." Science 15 July 1988.

Heifetz, Ronald A. and Riley M. Sinder. "Political Leadership: Managing the Public's Problem Solving." The Power of Public Ideas. Ed. Robert B. Reich. Cambridge: Harvard University Press, 1990.

Hicks, Donald A. "Foreign Ownership of Defense Firms Boosts US Security." Armed Forces Journal International October 1990.

Hout, Thomas and Ira Magaziner. Japanese Industrial Policy. Berkeley: University of California Press, 1980.

Hulten, Charles R. "Testimony, Committee on Banking and Urban Affairs, Subcommittee on Policy Research." Washington, DC: US House of Representatives, 1990.

Johnson, Chalmers. "Who's Afraid of Industrial Policy?" New York Times 16 Sept. 1990.

Johnson, Chalmers. MITI and the Japanese Miracle. Stanford: Stanford University Press, 1985.

Johnson, Chalmers. The Industrial Policy Debate. San Francisco: ICS Press, 1984.

Kapstein, Ethan B. "Losing Control: National Security and the Global Economy." National Interest Winter 1990.

Keller, Kenneth. "Science and Technology." Foreign Affairs. New York: Council on Foreign Relations, Fall 1990.

Kennedy, Paul. The Rise and Fall of Great Powers. New York: Vintage, 1987.

Kitfield, James. "High Tech Tightrope." Government Executive May 1990.

Krugman, Paul. The Age of Diminished Expectations. Cambridge: MIT Press, 1990.

Leopold, George and Neil Muro. "Budget Bill Bolsters Tech Base." Defense News 12 November 1990.

Luttwak, Edward. "Disarming the World's Economies." CE/International Strategies Oct.-Nov. 1990.

Lynn, Leonard H. "Technology Policy in Japan." Forum for Applied Research and Public Policy Fall 1990.

Manufacturing Studies Board, Committee on Computer Aided Manufacturing. Report on Activities, January 1980 to June 1981. Washington, DC: National Academy of Sciences, 1981.

Manufacturing Studies Board. Toward a New Era in US Manufacturing. Washington, DC: National Academy Press, 1986.

Manufacturing Studies Board, Committee on the Role of Manufacturing Technology Program in the Defense Industrial Base. The Role of the Department of Defense in Supporting Manufacturing Technology Development. Washington, DC: National Academy Press, 1986.

Manufacturing Studies Board, Committee on Industrial Mobilization. Industrial Preparedness: National Resource and Deterrent to War. Washington, DC: National Academy Press, 1990.

Manufacturing Studies Board. Manufacturing Technology: Cornerstone of a Renewed Defense Industrial Base. Washington, DC: National Academy Press, 1987.

Markoff, John. "New U.S. Aid Sought for High Technology." New York Times 26 April 1990.

Markusen, Ann R. "Defense Spending: A Successful Industrial Policy?" Berkeley: Institute of Urban and Regional Development, June 1984.

McCain, John. "The Destruction of America's Defense Industrial Base." Armed Forces Journal International June 1990.

Mellow, Craig. "The Superpower Paradox: Strength is Weakness." CE/International Studies October/November 1990.

Meyer, Herbert E. "Banker, Broker, Businessman, Spy." CE/International Studies October/November 1990.

Moran, Theodore H. "Economics and Security." Foreign Affairs. New York: Council on Foreign Relations, Winter 1990/1991.

Moran, Theodore H. "The Globalization of America's Defense Industries: Managing the Threat of Foreign Dependence." International Security Summer 1990.

Morici, Peter. Reassessing American Competitiveness Washington, DC: National Planning Association, 1988.

National Research Council. Toward a New Era in Manufacturing. The Need for a National Vision Washington, DC: National Academy Press, 1986.

New Republic. "The Visible Hand." 1990.

Nincic, Miroslav. United States Foreign Policy, Choices and Tradeoffs. Washington, DC: Congressional Quarterly Press. 1988.

Perry, William. "Defense Investment: A Strategy for the 1990's." Address. Kennedy School of Government, Harvard University, 10 October 1990.

Petre, Peter. "Lifting American Competitiveness." Fortune 23 April 1990.

Pinder, John, Takashi Hashomi, and William Diebold. Industrial Policy and the International Economy. New York: Trilateral Commission, 1979.

Preston, Richard A. and Sydney F. Wise. Men in Arms. New York: Preager Publishers, 1970.

Prestowitz, Clyde V., Jr. Trading Places: How We Allowed Japan to Take the Lead. New York: Basic Books, 1988.

Reed, Leon S. "Obsolescence, Declining Productivity, and the American Defense Mobilization Infrastructure." The US Defense Mobilization Infrastructure: Problems and Priorities. Eds. Robert L. Pfaltzgraff and Uri Ra'anana. Hamden: Archon Books, 1983.

Reich, Robert B. "The Quiet Path to Technological Preeminence." Scientific American October 1989.

Reich, Robert B. "Policymaking in a Democracy." The Power of Public Ideas. Ed. Robert B. Reich. Cambridge: Harvard University Press, 1990.

Rogerson, William P. Inefficiently Low Production Rates In Defense Procurement: An Economic Analysis. Cambridge: Olin Foundation, 1990.

Ropp, Theodore. War in the Modern World. New York: Collier Books, 1959.

Rosecrance, Richard. "Must America Decline?" Wilson Quarterly. Washington, DC: Autumn 1990

Rush, Benjamin. "Industrial Modernization." Program Manager. Fort Belvoir: Defense Systems Management College, Nov.-Dec. 1990.

Sammet George L. and David E. Green. Defense Acquisition Management. Boca Raton: Florida Atlantic University Press, 1990.

Seabury, Paul. "Industrial Policy and National Defense." The Industrial Policy Debate. Ed. Chalmers Johnson. San Francisco: ICS Press, 1984.

Schroeder, Michael and Walecia Konrad. "Nucor: Rolling Right Into Steel's Big Time." Business Week 19 Nov. 1990.

Schumpeter, Joseph A. Capitalism, Socialism, and Democracy. New York: Harper, 1950.

Smith, Bruce L.R. American Science Policy Since World War II. Washington, DC: Brookings Institution, 1990.

Spencer, William J. "Research to Product: A Major US Challenge." California Management Review Winter 1990.

Stevenson, Richard W. "Military Contractors Struggle As Rules of the Game Change." New York Times Jan 6, 1991.

Stoffaes, Christian. "Industrial Policy in the High Technology Industries." French Industrial Policy. Eds. Adams and Stoffaes. Washington, DC: Brookings, 1986.

Stokes, Bruce. "High-Tech Tussle." National Journal Supplement 12 June 1990.

Talaysum, Adil T., M. Zia Hassan, and Joel D. Goldhar. "Scale Versus Scope Considerations in the CIM/FMS Factory." Flexible Manufacturing Systems: Methods and Studies. Ed. Andrew Kusiak. Amsterdam: Elsevier Publishers, 1986.

Thurow, Lester. The Zero Sum Society. New York: Basic Books, 1990.

Uchitelle, Louis. "Not Getting Ahead? Better Get Used To It." New York Times 16 December 1990.

U.S. Congress, Congressional Budget Office. The Industrial Policy Debate. Washington, DC: GPO, 1983.

U.S. Congress, Office of Technology Assessment. The Defense Technology Base. Washington, DC: GPO, March 1988.

U.S. Congress, Office of Technology Assessment. Making Things Better: Competing in Manufacturing. Washington, DC: GPO, 1990.

U.S. Department of the Air Force. Air Force Systems Command Blueprint for Tomorrow. Washington, DC: 1980.

U.S. Department of Defense. Bolstering Industrial Competitiveness. Washington, DC: 1988.

U.S. Department of Defense, Defense Science Board. The Defense Industrial and Technology Base, Final Report of the Defense Science Board 1988 Summer Study. Washington, DC: Dec. 1988.